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AN
INQUIRY
INTO THE
PROCESS OF NATURE
IN REPAIRING
INJURIES OF THE INTESTINES:
ILLUSTRATING THE
TREATMENT OF PENETRATING WOUNDS,
AND
STRANGULATED HERNIA.

By BENJAMIN TRAVERS,

DEMONSTRATOR OF ANATOMY AT GUY'S HOSPITAL.
SURGEON TO THE HON. EAST INDIA COMPANY,
AND TO THE LONDON INFIRMARY FOR DISEASES OF THE EYE.

PRUDENS INTERROGATIO QUASI DIMIDIUM SCIENTIÆ.

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1812.

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TO
ASTLEY COOPER, ESQ. F. R. S.

&c. &c. &c.

THIS VOLUME IS DEDICATED,
AS A TRIBUTE
TO SUPERIOR PROFESSIONAL MERIT,

BY
HIS GRATEFUL PUPIL

AND
SINCERE FRIEND,

BENJAMIN TRAVERS.

PREFACE.

THE injuries, to which the animal body is exposed, may be naturally divided into two classes: the first, comprehending those which have an inherent power of redress; the second, those which tend to inevitable destruction. Wounds and fractures excite an action of reparation. The same blow which induces a cataract, often occasions its removal by absorption. An aneurismal tumor, by driving the blood into other channels, sometimes works its own cure. A multitude of similar examples crowd upon the mind of the thoughtful observer. On the other hand, there are injuries which carry death with them; which overwhelm if they do not annihilate the power of redress. Such

are effusions into the brain, thorax, or abdomen.

It is obvious that minute attention to the operations of the restorative principle will afford a clue to the rational treatment of those injuries in which it is displayed. Thus we have learned to unite wounds by adhesion, instead of leaving them to be filled slowly up with new matter—to rupture the capsule of the opake crystalline, in order to bring about its solution in the aqueous humour—to tie the diseased artery, more effectually to cut off the supply, and force the collateral circulation; and in the work which I now lay before the profession, my object has been in like manner to take a lesson from Nature. I have endeavoured to ascertain the plan and limit of her operations in an important class of injuries, to compare the facts of history with the results of experiment, and from these sources to derive a rational and consistent theory of treatment.

“ Without principles,” ‘ says an able French writer,’ “ practice is a mere routine ; the good or ill results of which the cause is not discerned, are equally lost to the progress of Art. The success which we cannot explain often leads us into error, and serves only to perpetuate, under the name of experience, a blind conduct, of which we know neither the good nor the evil *.”

It remains only that I offer my public and particular acknowledgments to my friends Dr. De Lys of Birmingham, and Mr. Hodgson of London, for much able and kind assistance in the prosecution of this Inquiry. To the latter I am also indebted for the drawings which accompany the volume.

* M. Goursaud in the Memoirs of the Academy of Surgery.

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INTRODUCTION.

THE numerous examples of spontaneous recovery from wounds of the intestinal canal, and our imperfect acquaintance with the method of cure which nature adopts in these cases, were the circumstances which led me to the present inquiry. I was additionally urged to prosecute it, by observing the varieties of opinion which embarrass the practice of surgeons and the questionable tendency of their proceedings, in cases of mortified hernia. The frequent success of the operation of nature in such cases, and the frequent failure of the contrivances of

art, are demonstrated by a reference to the sources of professional information ; and I trust it is unnecessary to argue the importance of an inquiry into the cause of this humiliating distinction.

The records of surgery abound with examples of intestinal injuries ; documents, it must be admitted, of much value, as they have furnished to subsequent inquirers important facts, of which many are still extraordinary and require elucidation. The observations to which these histories have given birth are generally of very inferior value, because if not drawn exclusively from the individual case, they do not originate in a comprehensive view of the principles upon which nature proceeds. Notwithstanding therefore, the ability of the writers and the copiousness of the details, their dissertations too frequently present shallow inferences and trifling proposals, and the confusion becomes greater as the facts accumulate. They seem in short, to have had no adequate

conception of the advantages of experimental research, or deterred by the difficulties attending this mode of inquiry, have preferred reasoning from superficial appearances, than which mere hypothesis is not more useless or more delusive.

The benefit which of late years has resulted to practical surgery from a diligent study of those secret processes by which nature accomplishes her operations, furnishes, I conceive, an irresistible argument for the necessity of experiments on brutes. It is a weak objection, although urged by some respectable authorities, that the difference of economy in animals of different species does not warrant the application of similar conclusions. Granting the points of difference, it cannot be denied that the points of analogy in the general structure and functions of all animals of the same class, infinitely preponderate. • And as human anatomy would have been yet very imperfect, and physiology altogether a conjectural science without the advantage which

this analogy has afforded, it is reasonable to presume that the doctrines of pathology must admit of a similar mode of illustration. Although the acknowledged varieties in the constitution of man and animals do not permit every inference from the powers and actions of one to be applied to the other, yet are there striking features of resemblance in the phenomena ensuing upon mechanical injury, some of which have already been applied, and more admit of application to important practical purposes.

A minute acquaintance with the operations of nature furnishes two leading indications. First—when and how to avoid a prejudicial interference with those operations: secondly—by what means to assist them when susceptible of aid. For want of this knowledge these indications have generally been overlooked in the treatment of intestinal læsions.

It cannot have escaped observation, that the practice of surgeons in the treatment of wounded intestines is indecisive, and

regulated rather by accident than principle; nor can persons accustomed to visit the wards of hospitals have failed to remark, in how many cases of strangulated hernia the symptoms survive the operation, or the miserable alternative of an artificial anus is a looked-for consequence. Some French surgeons, and in particular the intelligent M. Louis, have endeavoured by specious arguments to reconcile us to this disgusting infirmity: but it is a condition to which unassisted nature so rarely reduces humanity, that it ought to be regarded, with few exceptions, as an opprobrium of our art.

In the following pages it has been my object to advance from the most simple to the most complicated forms of injury to the intestinal canal, and to point out their respective consequences and treatment. Although in a practical view, the subject of intestinal wounds is perhaps of less pressing importance than that of hernia, yet the practice in both cases is so often injudicious

and so seldom proceeds upon any scientific principle, that I anticipate their reciprocal illustration from the present inquiry. To have illustrated either subject exclusively and at the same time comprehensively, would have been impossible. Their connection is equally essential and obvious.

CHAPTER I.

THE ABDOMEN FILLED BY ITS VISCERA
 —STRUCTURE OF THE INTESTINES—
 THEIR WOUNDS SIMPLE AND COMPLICATED — THE QUESTION, WHETHER
 WOUNDS OF THE INTESTINES ARE FOLLOWED BY EFFUSION OF THEIR CONTENTS INTO THE ABDOMEN, ILLUSTRATED BY EXPERIMENTS AND RECORDS.

THE language of anatomists has given familiarity to an expression which is, strictly speaking, inaccurate as applied to any part of an animal body : I refer to the term cavity.*

* Mr. Hunter's is a curious reservation. "There is no such thing in an animal body as empty space, *exclusive of outlets or reservoirs*, which cannot be reckoned internal or circumscribed cavities, for they are perfect by not being such." Are outlets and reservoirs then *empty spaces*? This is one of many examples to be met with in the writings of this great man, of expressions so defective in philosophical precision as to obscure the subject which they were intended to illustrate.

The misapplication of the term probably originated from an inspection of the visceral compartments after the removal of their contents: it could not arise from an inspection of the parts *in situ*, for the same pressure is exerted to maintain contact in the dead and living body. Every practical anatomist has a familiar illustration of the non-existence of an abdominal cavity in the operation of laying open the abdomen; for to avoid injuring the viscera in making the section of the parietes, he finds it necessary to raise them by previously introducing his finger. But it must be obvious to the slightest reflection, that while the exterior and interior surfaces of an animal body maintain a communication with the atmosphere, if it were possible to separate the parietes from the parts which they defend, and thus to create a cavity, the pressure of the atmosphere would instantly restore the contact and obliterate the cavity. It is upon this principle that the lungs follow the ribs, and the bowels follow the

diaphragm. If the chest or belly of a living animal could be inspected while the boundaries remained entire, it would be found that the contents were in actual contact with the parietes : that an intestine, for example, was on every side in contact with surrounding intestines, or with the peritoneum lining the muscles. Instead therefore of floating loosely, as has been represented, it is supported by the equable pressure of the parts in its vicinity, and all wounds penetrating the abdomen would of necessity penetrate the contiguous intestines, did they not oppose a resistance so slight as to be more readily displaced than wounded.*

The distension following a full meal, the impediment to respiration from tight bandages of the abdomen, and the production of hernia from forcible inspirations are proofs of an universal pressure.

* This mobility, it may be observed, diminishes the risk of injury to which parts are exposed, possessing only a muscular covering.

It may be proper to premise a few observations on the structure and morbid dispositions of the parts concerned in this inquiry. The containing and contained parts of the abdomen present to each other a uniform and continuous surface of membrane. This membrane is of the serous class, and the species of inflammation to which it is especially subject is that which has been denominated the adhesive. The membrane lining the intestinal canal is of the mucous class, and the ulcerative inflammation is the species to which this class is liable. This beneficent provision is an irresistible evidence of the operation of a salutary principle in disease. If the inflamed peritoneum had run directly into suppuration, ulceration of the surrounding parts would have been required for an outlet; and if the internal surface of the irritated bowel had tended to form adhesions, the canal would have been in constant danger of obliteration. The substance intervening betwixt these membranes presents two orders

of fleshy fibres—the external, longitudinal and disgregated—the internal, circular and compact. By a cellular texture the membranes are connected with the muscular fibres, the interior stratum being the more dense, and chiefly contributing to the strength of the canal.*

The viscera of the body, it is perhaps unnecessary to add, possess a degree of power to repair the effects of injury superior to that of parts more remote from the centre of circulation. But the importance of parts, the functions of which are of indispensable necessity to the vital economy, renders the danger of injury to them proportionally

* In confirmation of this fact Bichat gives the following ingenious experiment. “Prenez une portion d'intestin, enlevez lui dans un point quelconque cette couche ainsi que la sereuse et la musculuse ; soufflez-la ensuite, apres avoir liée inferieurement : l'air determine en cet endroit une hernie de la tunique muqueuse. Retournez ensuite une autre portion d'intestin ; privez là dans une petit espace de sa membrane muqueuse et de celle-ci : l'insufflation produira sur les tuniques sereuse et musculuse le meme phenomene que dans le cas precedent elle a determiné sur la muqueuse.”—Anatomie Generale, tom. iv. p. 421.

greater. Upon this principle læsions are more to be feared in the small than the large intestines. This fact did not escape the observation of the ancients though they exaggerated its importance ; for they pronounced wounds of the latter dangerous in the highest degree, those of the former without exception fatal.

Wounds of the Bowels may be divided into simple and complicated ; i. e. they occur with or without a wound of the muscular parietes. An intestine ruptured by a blow or fall upon the belly, or pierced by a foreign body lying within its tube, or opened by a process of disease, furnishes an example of the simple wound. In the complicated wound the gut is injured by an instrument or an ulcer which has penetrated the parietes, or a disease of the gut extends to the skin and forms an aperture in the integuments. This last is the case of a simple wound rendering itself complicated.

From a consideration of the probable con-

sequences of a wound of the intestines, a question very naturally arises, whether in wounds which do not evacuate the bowel externally to the body, its contents will not be poured into the abdomen. I have never met with any attempt at a precise description of the cases in which effusion happens, nor any explanation, not obviously hypothetical, of the principle upon which it is in any case prevented. The point therefore, appears pressing for investigation, not less from its obscurity than its importance.

It being admitted that there are cases in which effusion does take place, it is easy to conceive circumstances which must considerably influence this event. If for example, the stomach and bowels be in a state of emptiness, the nausea which follows the injury will maintain that state. If the extent of the wound be considerable, the matter will more readily pass through the wound than along the canal. A wound of the same

dimensions in the small and the large intestine, will more readily evacuate the former than the latter, because it bears a larger proportion to the calibre. Incised and punctured wounds admit of the adhesion of the cut edges, or the eversion of the internal coat of the gut, so as to be in many instances actually obliterated; whereas lacerated or ulcerated openings do not admit of these salutary processes. Again, in a transverse section of the bowel, contraction of the circular fibre closes the wound, whereas in a longitudinal section, the contraction of this fibre enlarges it. Such are the circumstances which, combined in a greater or a less degree, increase or diminish the tendency to effusion.

M. Petit, in an essay published in the *Memoirs of the Surgical Academy of Paris*,* has asserted that effusion is resisted during life by the mutual contraction of the muscles

* Suite de l' *Essai sur les Epanchemens*. Par feu M. Petit le fils. Tom II. (4to ed.) P. 92. and seq.

and intestines, and that consequently when this resistance has ceased, as after death, effusion readily takes place. To the frequency of its appearance which he asserts, Petit attributes the prevailing, but as he alleges inaccurate opinion, that it occurs during life. He further asserts that no effusion can take place from vessels which have no action, nor until the proper action of the wounded vessel overcomes the resistance opposed by the action of surrounding parts. It is astonishing that a writer of Petit's reputation should have involved himself in such glaring absurdities. Granting the assumption of effusion after death, I would enquire, what is the nature of the *action* exerted by a dead intestine, and from what cause, or in what degree, its *proper action* is superior to that of the surrounding parts? But how stands the fact? I assert that effusion from a wounded bowel meets with the same impediment in the dead as in the living body, the resistance being purely

passive. If therefore effusion depends, as I am quite willing to admit, upon the action of the wounded vessel overcoming the opposed resistance, it follows that it can never happen after death, because action has ceased whilst resistance remains the same.

The simple principle, to which I have before adverted, of equal and uniform pressure, is that which can alone oppose a steady and efficient resistance to the effusion of the alimentary matter. That in many cases it does oppose such resistance, and that in some cases it fails, will be established by facts which I shall now bring forward; and they will lead to this general conclusion, that the event of effusion is to be apprehended in proportion as this passive resistance is counteracted by the circumstances of the injury.

EXPERIMENT A.

A mare condemned for glanders was wounded by a small sword in the flank, to the depth of more than a foot. In five hours and a half she was knocked down. The small intestines, cæcum, and mesentery were wounded in several places. The wounds were of a dark colour, their edges in contact, although not adhering. About a quart of clear serum was contained within the peritoneum, which was universally discoloured. But although the animal had fed freely before the injury, no fæculent effusion could be discovered.

EXPERIMENT B.

The same instrument was plunged deep into the belly of a glandered horse, and immediately withdrawn. It passed in an oblique direction between the last rib and os innominatum. The animal survived about sixteen hours. On opening the abdomen which was

tympanitically distended, the intestines appeared tumid with air. The perforations were as follow : one through the ilium, two through its mesentery, three in the colon and rectum, and several through the mesocolon. The wounds presented no eversion, but their edges were of a livid colour, covered by a little clotted blood, and surrounded by a slight ecchymosis. Not a particle of fæculent matter was effused, but on raising the bowels there appeared a quantity of sanious serum, holding loose flocculi of lymph. Lymph was also disposed in shreds over the peritoneal surface. The bowels had contracted no adhesions.

To these experiments I may add the history of a similar injury inflicted upon the human subject. Three young sailors were brought from Deptford to St. Thomas's Hospital, on the morning of Thursday, the twelfth of January, having each received a bayonet wound in an affray with a press-gang on the night preceding. One of them was stab-

bed low in the left hypochondrium, the external wound being about half an inch in length. He complained of acute pain in the epigastric region, and vomited his food and medicine as soon as he had swallowed it. His abdomen was not tense, though painful on pressure in the vicinity of the wound; his pulse 120 and hard. On the morning after his admission his pulse had acquired greater frequency, (130) and a wiry hardness. He was continually vomiting. He had passed two stools untinged with blood; his belly was natural to the touch, and when questioned as to pain, he expressed that he was easy. Towards evening he became delirious, and his pulse was innumerable from quickness, and exceedingly small. Sickness had continued without intermission, and his vomit was now fæculent. At night he died. Upon inspection of the abdomen which had become tumid, the small bowels appeared greatly distended and streaked with red dotted lines. The mem-

brane of the parietes was uninflamed. A quantity of soft, unarranged lymph, uniform in appearance, was deposited upon the surface of the bowels. The injury was ascertained to be as follows. The bayonet had cut away the cartilage of the eleventh rib, then gliding obliquely behind the arch of the colon, entered the jejunum at its commencement on the left side of the spine, and traversing the duodenum, had perforated this intestine at its second turn. From the absence of fæculent matter, the natural concealment of the injured bowel, and the perfect closure of the wound, it very narrowly escaped detection. It was in drawing the jejunum upwards from the spine, that a stream of fæcal fluid from two to three lines in diameter gushed from the wound, the edges of which had contracted a slight adhesion. By filling the bowel with water the second wound was discovered. It was so firmly united as for some time to resist a considerable distending force. The external

circumference of both wounds was livid, and the internal highly inflamed. I have subjoined a sketch, shewing the size and direction of the wound.*

In the Memoirs of the Academy of Sciences, anno 1705, is recorded a very singular case, by the celebrated M. Littre. It is valuable on many accounts. A man, æt. 34, of a robust constitution, who was occasionally the subject of mental derangement, inflicted eighteen wounds upon his body with a knife, the blade of which was five inches long, and seven lines broad at the handle. Of these wounds eight had penetrated the abdomen. Tension of the belly, difficult and painful respiration, nausea, and vomiting ensued. Blood was passed by the mouth and by stool. By means of copious bleeding and a strict regimen the patient recovered in the course of two months. During the cure the body was preserved in

* Plate 1.

the supine posture, that if possible the effusion which was expected might be restrained; for from the direction and depth of the wounds and the passage of blood by the bowels, no doubt was entertained that these parts were penetrated. In a returning paroxysm, eighteen months subsequent to the former violence, the unfortunate man destroyed himself by leaping from a window three stories high. This event afforded M. Littre a highly interesting opportunity of ascertaining the existence and mode of reparation of the intestinal wounds. It is sufficient for my present purpose to say, that the *jejunum and colon presented extensive cicatrices.*

I had prepared to lay before my reader the reports of cases, which having proved fatal had become the subjects of examination, for the purpose of deciding the point in question. But although in the greater number of these cases, the writers preserve a total silence respecting

effusion,* and we are therefore at liberty to infer that no such event had taken place, there is so little evidence that the attention of the anatomist was directed to this point, otherwise difficult to be ascertained, and the description of appearances is so

* Vid. Bonet. Sepulch. Anat. Lib. iv. Sec. 3. Salmuth Cent. i. Obs. 18. Morgagni, Lett. liv. Art. 31. La Motte, Traité de Chirurg. Tom. 2. ch. 8. obs. 100. 103. &c. Petit, Essai sur les Epanchemens, prem. part. Mem. de l'Acad. de Chirurgie. Tom. I. p. 237. etc.

It would be improper however, not to notice two cases in which effusion is distinctly stated.—In March, 1705, La Motte was consulted about a young gentleman wounded in the epigastric region. Until the fifth day the symptoms afforded no evidence that the intestine had been touched. At this time the pulse sunk, the belly swelled, the patient was distressed with nausea and vomiting, and died on the eighth day. The ileon was pierced in three places, but the wounds were so small, that they would not have been perceived but for the effusion of the fæcal matters.—“Je trouvai l'intestin ileon percé en trois endroits, mais de playes si petites qu'à peine je le pûs appercevoir sans qu'il y eut aucune matiere epanchée dans le bas ventre.”—Traité complet de Chirurgie. vol. 2. p. 428. It is rather singular, that the same M. La Motte should have met with two cases in which the ileon was wounded in several places and extensively, in which no effusion had ensued, and with a third case in which effusion had taken place from openings so small as to be scarcely discoverable. It is singular that a patient should survive an effusion for a period of eight days, and more so, that for the first five days he should suffer no inconvenience from it. But

generally defective in precision, that I could attach no importance to arguments derived from such a source.

the most extraordinary circumstance of the case is, that a wound so small should have admitted of effusion. It is contrary to rational expectation, that from a tube so nearly perfect, and offering no resistance to the progress of its contents, they should escape in a direction perpendicular to the axis of the canal, opposed by the pressure of the surrounding parts. It is also contrary to experience, as has been demonstrated, and will be yet further confirmed in the progress of this inquiry. A sanious fluid, the product of peritoneal inflammation, which there can be no doubt was the real cause of this young man's death, might easily be mistaken for the effusion which La Motte anticipated.

Garangeot has a case in his *Memoir** on this subject, as little reconcileable with probability. The wound was inflicted with a hanger, below the last false rib. It happened two days before Garangeot was consulted, and the man died on the fifth day. Upon opening the peritoneum, a fluid gushed forth, tinged with the *color* of the *chylous* matters. In its most posterior convolutions the ileon was pierced in two places. In this case we are given to understand that the patient survived for five days an effusion of chylous fluid, of which the undulation, as of the water in ascites, was distinctly perceptible on the second day. Garangeot ought to have known that the contents of the ileon do not preserve the *chylous* aspect, though he may be excused for ignorance of the appearances which the more recent development of the phenomena of inflammation has rendered familiar at the present day. Those who are familiar with the appearances which the abdomen presents under inflammation, will readily recognise an appearance of turbid serum, re-

* *Mem. de l'Acad. de Chir.* Tom. ii, p. 119,

From the above facts it appears that effusion is not an ordinary consequence of penetrating wounds. That the same opposition to effusion exists after death as before it, and consequently that such opposition must depend on passive pressure, not on active resistance. If the gut be full and the wound extensive, the surrounding pressure is overcome by the natural action of the bowel tending to the expulsion of the matters. But in defect of either of these states, effusion cannot follow. If the canal be empty at the time of the wound, no subsequent state of the bowel will cause effusion, nor can effusion take place from a bowel at the moment full, provided it retains a certain portion of its cylinder entire.

resembling whey, which it was very natural under certain prepossessions, to mistake for a chylous effusion. I have oftener than once seen a deposition of soft lymph mistaken for alimentary matter, when a closer examination made the difference manifest. But the knowledge of morbid appearances requisite for conducting anatomical investigations with accuracy, the older writers did not possess in a degree sufficient to justify implicit confidence in their statements.

The facts which have led me to this conclusion I reserve for the illustration of other points of inquiry in the ensuing pages.

When however, air has escaped from the bowel, or blood has been extravasated in quantity within the abdomen at the time of the injury, the resistance opposed to effusion will be less effectual, although the parietal pressure is the same, as such fluids will yield more readily than the solids naturally in contact. To this opinion which is consistent with the ordinary effects of pressure, I was led by the corresponding results of several experiments.

Cases may be cited which give authority to this opinion. That of the miller's servant related by Morgagni is conclusive. This man was stabbed with a butcher's knife in the epiploic region, and after violent convulsions died about the fortieth hour. "The transverse and oblique muscles were perforated with a wound, that would admit two fingers, and between them the

air had entered, so that a beginning emphysema was brought on. This air had got out of the colon which was wounded into the cavity of the belly, and had distended it; *nor had air alone come forth but the excrements also*, so that although a fluid was extravasated in the belly to the quantity of two pounds, the greater part of it was excrementitious, and very little blood, no considerable vessel having been injured.”* Cases of fæcal effusion accompanying extravasation of blood, are recorded by Baltazar Timæus,† Hoyerus,‡ Ravaton|| and others.

Saltzman has a case in which three or four lumbrici had escaped from a wound of the ileon. I have often met with this circumstance in dogs whose intestines generally contain worms, but it is evidently a peculiar case to which no reasoning on the effusion of inanimate matter can apply.

* Lett. 54, Art. 37. Alex. Trans.

† Respons. Med. 17.

‡ Act. Nat. Cur. Tom. iii. Obs. 18.

|| Traité des Playes &c. Obs. 62.

I have hitherto confined the illustration of my opinion concerning effusion to the cases which have furnished ocular evidence : I shall now briefly refer to cases which though they have not afforded this species of evidence, are equally decisive of the question. I allude to cases of deep penetrating wounds, the effects of which have been perfectly recovered. Petit imagined that a circumscribed depôt of fæcal matter, such as has been observed of blood or pus, might be formed in the abdomen. He employed his hypothesis to explain in what way it was pressed into a corner, and its diffusion prevented.* It would be trifling with the time of my readers to enter into a refutation of these conceits, or it would be easy to invalidate Petit's inferences by the examples which he has cited. In all the cases which

* There is something extremely ridiculous in this distinction between *effusion* and *diffusion*; for if the former takes place, the resistance is overcome which is under less advantageous circumstances to oppose the latter.

give the slightest countenance to this opinion, we find that a rupture pre-existed, by which the gut had contracted an adhesion to the peritoneum. Such is the obvious explanation of the cases of Collignon and Pineau.*

It is at the present day generally admitted, that effusion from the intestine in whatever degree is fatal; and this impression joined to the prevailing idea that it is the uniform consequence of a wound, places the practical importance of the present question in a strong point of view. It is probable that in many cases on this account abandoned as hopeless, the efforts of the practitioner might have been successfully exerted to suppress the inflammation inseparable from the injury.

Deodatus in a letter to Hildanus gives the case of a young weaver stabbed with a small sword. The sword entered above the umbilicus, and made its exit on the left loin. Fever

* Essai sur les Epanchemens.—Mem. de l'Acad. Tom. ii.

ensued, and grumous blood was brought away in quantity from the bowels. In a few weeks the patient was tolerably recovered; but when the wound had healed a tumor arose, accompanied with sharp pain. After twelve months' suffering, the point of the instrument which had been broken in the belly was voided *per anum*. Hildanus supposes that the colon was transfixed near its attachment to the left kidney. The attending surgeons were of opinion that the small intestine was the seat of the injury.*

“Toutesfois,” says the venerable Paré, “j’ay pansé plusieurs qui avoient des coups d’épée et des pistolets, *au travers du corps*, qui sont guéris. Mesure ces derniers jours, je fus appelé pour un gentilhomme, natif de Paris, nommé Gillet Le Maistre, Seigneur de belle Jambe, demeurant à la rue St. André des Arts, avec Mess. Botal, médecin ordinaire du roi et de la reine, Richard Hubert, chirurgien ordinaire du roy du dit

* Fab. Hildan. Obs. Chirurg. Cent. v. Obs. 74.

seigneur, et Jacques Guillemeau, chirurgien du roy et juré à Paris, hommes scavans, et bien experimentés à la chirurgie, lequel avoit recû un coup d'épée tout au travers du corps, dont par plusieurs jours jetta la sang par la bouche et siege en assez grande quantité, qui denotoit les intestines être offensés. Toutesfois en quinze ou vingt jours il fut guery.*”

Wiseman relates a story of a man run through with a rapier entering in the right hypochondrium, and passing out at the back. On the following day his skin was hot, and his pulse a little disturbed, but he recovered without any symptoms denoting wounded viscera. “Thus,” says Wiseman, “it frequently happeneth that a sword passeth through the body without wounding any considerable part.”† The same conclusion has been made by others where the accident was attended with only a slight degree of

* Œuvres de Paré. De plaies du ventre, liv. 10, cap. 35.

† Wiseman's Surgery, P. 371.

symptomatic fever.* Thus Garangeot in his surgery gives a history in which a sword traversed the belly, entering below the xiphoid cartilage, and presenting between the third and fourth false ribs of the right side. So slight were the symptoms, that on the tenth day the patient resumed his ordinary occupation. I must observe that there is no authority for the inference of Wiseman and Garangeot. If the abdomen be at all times in a state of fulness, as has been established, it is impossible that an instrument should perforate it without injury to its contents ; such an occurrence has never been proved to be possible, much less to have taken place ; while on the other hand, it has been clearly and repeatedly demonstrated, that very slight and apparently inadequate symptoms ensue upon ascertained wounds of intestines, under circumstances in which their reparation is easily effected.

* Morgagni, Lett. 54, Art. 7.

The ninety-seventh observation of La Motte is a parallel to that of Garangeot. It is the case of a young gentleman whose abdomen was perforated from side to side: the sword entering between the false ribs and the crista of the ilium, and re-appearing at the corresponding point of the opposite flank. La Motte bled him largely, gave him a full vomit, dressed the wounds lightly and sent him into the streets well on the eighth day.*

A case similar to Wiseman's is recorded by Muys. The subject was a young man, twenty years of age. The sword's point appeared at his back. "For some days he kept his bed" says Muys, "and complained of this and that discommodity, but waxed better from day to day."† A full and interesting narrative of this kind is also given by Camerarius,‡ who at the same time refers to an example of a similar injury,

* *Traité complet de Chirurgie.*

† *Rational Practice of Chirurgie*, Lond. 1686.

‡ *Act. Nat. Curios.* T. 1, Obs. 158.

from which the patient recovered in the short space of ten days. In Camerarius's case the perforation was again complete; the anterior orifice between the left breast and the umbilicus, the posterior on the same side of the spine, just below the last false rib. Frequent and copious vomiting of blood succeeded, and the pulse was at first somewhat affected, but no further symptom of injury appeared. Within fourteen days the patient was perfectly restored.

In Albucasis, we read of an arrow penetrating into the belly, which he expected would prove mortal; but at the end of thirty days, the patient remaining well, he cut upon and extracted it without any ill consequence. And in a similar instance the wound was consolidated while the shaft remained within the abdomen, by which the natural operations were in no respect disordered.*

Numerous instances of penetrating gun-

* Lib. 2, Cap. 96.

admixture of red globules and fragments of coagulable lymph."


These results however are not uniform. The following case is a striking exception, with which I was obliged by Mr. Norris, Surgeon to the Charter House.

"Mr.——I was informed, had for some time passed bloody and purulent stools, and the extremely emaciated state of his body led me to suspect, that some part of the alimentary canal had been the seat of disease. The liver, spleen, pancreas, and kidneys were all sound. The stomach was likewise free from disease, as indeed all the intestines appeared to be upon a superficial view: but upon a closer examination, the cæcum was discovered to be the diseased part. The sides of this gut were greatly thickened, and of a scirrhus hardness; and on its upper side was an opening from ulceration, large enough to admit my thumb. This had clearly been a gradual and slowly increasing disease, and during its continuance death had been pre-

vented by a very extraordinary operation of nature. The omentum, which naturally lies loose over the intestines, had formed adhesions to the peritoneum and the cæcum, so as completely to prevent the effusion of fæces into the abdomen."

I have likewise seen an extensive ulcer in the posterior surface of the stomach covered by an adhesion of the peritoneum to its margin, and a case has recently been communicated to me in which a portion of the colon contused by a blow had sloughed, and the aperture was defended by the inflammatory adhesion of the contiguous fold. Indeed it would be difficult to explain the process of cure in gunshot wounds, but upon the supposition that at the line of separation the gut adheres to the adjoining fold; and this supposition is confirmed by the evacuation of sloughs per anum.

A third species of simple wounds is that formed by the passage of worms or foreign bodies through the paries intestinalis. These



are rare. We have no authority for supposing that they are followed by effusion. Heister opened a boy who died of worms. A number of small lumbrici were discovered among the convolutions of the bowels, of which one was yet alive, though the child had died the day before. The small intestines exhibited numerous apertures by which these animals had escaped into the abdomen. In the remarkable case of Cummins, whose body was inspected at Guy's Hospital, the intestine was perforated in one part and transfixed in another by the blades of knives which had been swallowed, but the apertures were so completely occupied by the instruments as to prevent the escape of fluid.

It is evident from the above cases, that effusion is not restrained by the integrity of the abdominal parietes, nor in any degree promoted by the division of them to an extent insufficient to admit of a prolapse of the intestine. This circumstance therefore yields no explanation of the greater ten-

dency to effusion in the latter class of injuries. I should explain it by the difference in the nature of the injury which the bowel sustains, when perforated by a sword or bullet as in the one case, or burst or ulcerated as in the other. A rupture by concussion could only take place under a distended state of the bowel, a condition most favourable to effusion, and from the texture of the part, a rupture so produced would seldom be of limited extent. The process of ulceration by which an aperture is formed, commences in the *internal* coat of the bowel, which has always incurred a more extensive læsion than the peritoneal covering. The puncture or cut is merely a solution of continuity in a point or line, the ulcerated wound is an actual loss of substance. The consequence of this difference is, that while the former if small is glued up by the effusion from the cut vessels, or if large is nearly obliterated by the full eversion of the villous coat, the latter is a permanent orifice.

subject of intestinal disease, in the presence of Drs. Marcet and Laird. The small bowels were from their commencement partially inflamed, and towards the termination of the ileon were found not fewer than eleven ulcers, varying in size from the diameter of a goose-quill to that of a sixpence, from which a quantity of fæculent matter had passed into the pelvis. Seven of the largest of these were complete circular apertures with thin edges, the villous coat being more extensively destroyed. The glands of the mesentery were in various states of enlargement and imperfect suppuration; the large intestines healthy. The peritoneal surface exhibited an inflammatory blush, which we attributed to the irritating quality of the fluids effused. There was no vestige of an adhesive process.

A child four years of age, a patient of Mr. Phillips of the Borough, having exhibited signs of mesenteric disease, was seized on a sudden with violent pain in the belly, attended with vomiting, cold extremities, low

and scarcely perceptible pulse, laborious respiration, and a general appearance of delirium. His belly was swollen, and the pain increased upon pressure. In twenty-eight hours from the accession of symptoms, the child died. Upon inspection, the abdomen presented a mass of enlarged mesenteric glands, some containing caseous matter in the centre, others ulcerated. With these a portion of ileon on the right side of the abdomen was involved; and an aperture formed in that intestine which would receive the point of the little finger, had permitted an abundant evacuation of faecal matter. A morbid discolouration had taken possession of the whole peritoneal surface, but no adhesions were formed.

While this sheet was preparing for the press, I was demonstrating the muscles upon the body of a man who died of a dysentery. On opening the abdomen, a very copious collection of faeces appeared upon the surface

of the bowels, and a fæculent fluid escaped to the quantity of several pints. The bowels, excepting the duodenum, were nevertheless universally adherent and coated with a ragged lymph. The stomach and canal was healthy as far as the ileon. The villi of this intestine were tumid, pulpy, and specked with blood; and towards its termination, it was curiously coiled upon itself so as to stricture the canal. In this part and in the colon, numerous ulcers appeared which had destroyed the villous coat to the breadth of a shilling, and of which several were complete apertures.

For the following particulars of an inspection, in which it will appear that no adhesion existed to prevent effusion from an ulcerated aperture of the duodenum, I am indebted to Dr. Farre.

“ The symptoms of acute peritoneal inflammation were well marked, and the progress of the disease was rapid. It terminated fatally in thirty-six hours after vomit-

ing commenced. It was ascertained by dissection that every part of the peritoneum was inflamed. The following was the chief circumstance in which it differed from ordinary cases of peritonitis : a circular aperture in the peritoneum, large enough to admit a crow's quill, was found at the junction of the duodenum and stomach. It was the centre of an ulcer that had destroyed the villous and muscular parts of the duodenum, to the extent of half an inch. The inflammation was greatest on the peritoneum which lined the diaphragm and invested the small intestines and viscera of the pelvis. Coagulable lymph was effused about the pylorus, but not in sufficient quantity to produce an adhesion of the adjoining parts, so as to exclude the aperture from the cavity of the peritoneum. *The margin of the aperture was deeply coloured with bile,* yet the contents of the peritoneum seemed to be nothing more than serous effusion, rendered turbid by a slight

shot wounds have terminated as happily;* of which some interesting examples occurred in the practice of Ravaton.† A musket-ball was shot into the belly of a poor man of Padua; in three days it passed by stool and he recovered.‡ Two cases nearly similar are given upon the authority of Patin§ and Francus.||

I might have extended this research, but it appears already sufficient to justify the assertion, that effusion is a very rare consequence of penetrating wounds. I repeat, that it can only happen where the gut

* The case of a military officer now living, which excited much public attention some years ago, was remarkable. The bullet, I was informed by Mr. Heaviside, passed obliquely across the belly from the right to the left side.

† *Traité des Playes d'Armes à feu*. Ch. vi. “Cette observation prouve clairement la lésion d'intestin, puisque le lingot est sorti par le fondement; *mais comment se peut-il faire que les matières fécales et chileuses ne se soient point épanchées dans la capacité de l'abdomen?*”—Réflexion. Obs. 63.

‡ Eggerdes, *Ephem.* Dec. 3, A. 4, Obs. 10.

§ *Ibid.* Dec. 2, Art. 1, Obs. 20.

|| *Ibid.* Obs. 26.

See also Ravaton's *Chirurg. d'Armée*. Alex. Benedictus, Lib. 21. C. 36.—Paræus, Lib. 9. C. 34; and Lib. 24. C. 19. Mursinna, Loeseke, et alii in *Ploucquet Literat: Med. Digest.*

is full and the wound extensive. I have abundant proof that if these circumstances are uncombined, effusion does not ensue. Some modification of this statement is required in the case of an interposed fluid, for reasons before assigned.

Where the integrity of the abdominal parietes is preserved, as in those which I have denominated simple wounds, it is remarkable that effusion more generally follows. These are ruptures of the bowel produced by falls or blows upon the belly, where the integuments are even unabraded. The following is an example.

A man was brought into St. Thomas's Hospital, having received a blow from the shaft of a long hammer upon the pad of a truss, which he wore for a bubonocoele. He was soon seized with excruciating pain in the belly, which continued without interruption till his admission into the hospital. He was restless, tossing from side to side in bed, his pulse accelerated, and the upper parts

of his body covered with a clammy sweat. Clysters were returned mixed with blood. The next day his countenance expressed great anxiety ; his pulse was frequent and very small. He was freely bled without any mitigation of symptoms. His strength declined, and he expired in forty-eight hours after receiving the injury. On carefully inspecting the abdomen, a considerable quantity of fluid appeared, in which could be plainly perceived particles of castor oil, which he had swallowed some hours before his decease. A circular aperture with a ragged margin, of a size equal to the tube of a writing pen, was discovered in the ileon. The peritoneal surface was discoloured and coagulated lymph shed among the intestines. For another example of this fact, I refer the reader to an apposite case contributed by Mr. Norris to Mr. Cooper's work on Hernia.*

* Vide Case of Serjeson, pref. to Part II.

The instances of this species of injury ascertained by dissection, are numerous and from good authority:* most of them state the fact of fæcal effusion; the effusion of blood is likewise frequently mentioned. The extravasation of fæcal matter seems to have been regarded as a consequence so inevitable of a rupture of the bowel, that the notice of the former circumstance after the mention of the latter probably approached somewhat in the writer's idea, to the nature of an identical proposition.

A second species of simple wounds commonly attended with effusion is that which results from disease, for the most part ulceration of the gut. In the summer of 1808, I inspected the body of a female child, the

* Vide Wolfius. Phil. Trans. vol. xl. p. 61. Meckel. Mem. de l'Acad. des Sciences de Berlin. Tom. xiv. An. 1758. Morgagni. Lett. liv. Art. 14. et seq. Vollgnad Ephem. Germ. Dec. 1, An. 1, Obs. 21. Ibid. Helwick Dec. 3, An. 9 and 10, Obs. 120. Ibid. Dec. 2, An. 10, Obs. 290, 297, 331. Kramerus, Com. Lit. Nor. A. 1740. Hebd. 26, No. 2. Bonet. Sepulch. Anat. Lib. 3, Obs. 25, 27, and 47. Haller Opusc. Pathol. Obs. 25. &c.

The physical circumstances therefore of these injuries are essentially different in the resistance which they oppose to effusion. In the lacerated wound this event is uniform ; and in the ulcerated opening, the susceptibility of the surrounding margin for the adhesive process, by which it approximates to the character of the incised wound, constitutes the only means by which it can be prevented.* This, it has been shewn, is a process of uncertain occurrence, determined by incidental circumstances which it is not easy, if possible, to explain.

* ‘Quibus intestina exulceratione perforantur; nunquam fere cicatricem contrahunt, nam stercore naturales vires opprimuntur.’—Marcel. Donatus de Med. Hist. Mirab. Lib. v. Cap. 4. p. 206.

CHAPTER II.

REMARKS ON THE ADHESIVE INFLAMMATION OF THE PERITONEUM—PROCESS OF RÉPARATION IN THOSE COMPLICATED WOUNDS WHICH ARE UNATTENDED BY FÆCULENT DISCHARGE, OR PROLAPSE OF THE BOWEL—THEIR CONSEQUENCES AND TREATMENT.

THE disposition of the pleura and peritoneum to assume the adhesive inflammation is well known to anatomists.* Various causes induce this inflammation. From the frequency of pulmonary adhesion it would appear, that the pleura is more sub-

* The deeper seated parts of the body, and more especially the vital, very readily admit of the adhesive inflammation, which is proved by dissections; for we hardly ever open a human subject where there are not in the circumscribed cavities considerable adhesions.—Hunter on the Blood. p. 235.

ject to it than any membrane of the body. Chronic adhesions are less frequently met with in the abdomen.

This inflammation, induced by wound or displacement of the bowels, is rapid in its occurrence. I wounded the bowel of a rabbit, and in seven hours the adhesion of the cut edges of the gut to the wound of the parietes was firm and complete. I suffered the intestines of a dog to prolapse extensively, and having returned them *en masse*, found them matted together, and their interstices filled with lymph in fourteen hours.

A breach of continuity and a violent separation of parts naturally in apposition, are two powerful exciting causes of the adhesive process. Wounds and fractures are examples of the first; the forcible detachment of contiguous parts with which these are often accompanied, exemplify the operation of the second cause. In abdominal wounds, where the bowels suffer no

prolapse, the first of these causes operates exclusively: in those which are accompanied by displacement, these causes operate in conjunction.

In the abdomen, the moveable as well as the fixed viscera preserve a certain relative position, adapted to the performance of their several functions. In a prolapse of the bowel through an opening of the parietes, the protruded folds undergo a change of relative position, greater or less according to the extent of the protrusion. If the intestine be gradually and softly returned in its natural order, it recovers position and function without much consequent inflammation; if on the other hand, it be put back in the mass without attention to the course of the canal, its organic function is suspended, and it becomes an irritant. Inflammation rapidly supervenes, lymph is effused in flakes, and the folds are universally agglutinated. In those volvuli and knots of the

bowels occasionally met with, the folds implicated are glued definitely and firmly together,* and in hernia, where there is much dragging and displacement of the folds, a general adhesion of the convolutions prevails. It becomes therefore a most important object to restore protruded intestines to their natural order, not only to facilitate the passage of the alimentary matter, but to prevent the speedy formation of those extensive adhesions, which prove a permanent and insurmountable barrier to the functions of the canal.† The adhesive inflammation is always most circumscribed when the bowel does not prolapse; having prolapsed, it is for the most part proportioned to the extent

* I lately met with three complicated volvuli in the course of the ileon. Through their whole extent the folds engaged adhered by close membranous bands of such firmness, that in attempting to separate the convolutions, the peritoneal coat uniformly yielded. There was no instance of adhesion in any other part of the canal. The patient had been the subject of two inguinal herniæ of the reducible species.

† Debet medicus priora semper intestina quæ posteriora prolapsa sunt, condere sic, ut orbium singulorum locum servet. Aul. Corn. Celsi Medic. Lib. vii. Cap. 16.

of the displacement which obtains after its return into the abdomen. These points will be hereafter further illustrated by the results of experiment.*

* I am aware that other causes may co-operate in inducing this inflammation, and as the extent of the inflammation generally corresponds to that of the prolapse, the exposure to atmospheric air might be considered a sufficient explanation of the appearances. But those who attribute such important consequences to this agent, cannot be unacquainted with histories in which the orderly return of half the intestinal canal has been made with comparative impunity, after exposure for a considerable time to the air and all its impurities; and the experiments of Dr. New, although they have very satisfactorily decided, that inflammation is induced by the presence of atmospheric air in the belly, also shew that it produces effects widely different from those which ensue upon disturbed position. He injected eight ounces of atmospheric air from a caoutchouc bottle into the belly of a rabbit, which did not affect the animal in any degree until the fourth day. “Tandem autem, quarto post mane, animal male habere visum est. Non enim cibum eâdem quantitate, ut mos erat, appetivit; graviter doluit; humisese sæpe volutavit; et gravem dolorem cepit ex corpore ejus, præcipuè autem abdomine contrectato. Se pejùs pejùsque habere visum est, usque ad *septimum* diem; quo *occisum est*,” &c. “Abdomine patefacto, interna peritonæi facies et ea etiam intestinorum, manifesta inflammationis signa ediderunt. Intestina, hîc illic, sibi invicem, aut contiguo peritonæo adhærebant, et parva quantitas effusi liquoris, sero similis, conspiciebatur in abdomine.”*

* Disputatio Med. Inaug. Edin. 1795.

EXPERIMENT C.

To ascertain the mode of reparation adopted by nature in penetrating wounds, unattended by exposure of the gut, the abdomen of a dog was pierced by a paracentesis trocar, directed obliquely from the flank toward the stomach.

He fainted, but in a short time recovered, ate, drank, and passed his excrement as usual. On the fourth day he was killed. The wound of the peritoneum was marked by a slight ecchymosis. The duodenum had been fairly transfixed. Each orifice was concealed by a portion of the omentum, which lies on the side of this bowel. It had contracted a firm and well defined adhesion to the margin of the wound, denoted by a circular line of a florid red colour. Not a trace of inflammation was elsewhere visible. The stomach and bowels were loaded and in full action.

EXPERIMENT D.

A dog was wounded in the belly with an amputating catlin pushed home to the shoulder. He lay in a bent posture, and seemed to suffer severely for the remainder of the day. On the succeeding morning he had much recovered and took a little food. After a short time he was perfectly restored, and became as sharp and lively as before.* At

* The reader is probably acquainted with the common operation of paunching cattle, as practised among farmers. By feeding upon clover or vetches oxen are subject to an excessive distension of the abdomen, which suffocates them unless speedily relieved. In this state a knife is thrust to the depth of several inches into the belly of the animal, which operation being followed by a very copious discharge of flatus with a hissing noise from the wound, the tumefaction gradually subsides to the perfect relief of the beast. "This case," says Cheselden, "happening very rarely to men, I believe that practice has never yet been used; though the instrument which is used for tapping in dropsy of the abdomen, might do it with great ease and safety."*

Such an operation was lately performed under the following singular circumstances upon the human subject. A surgeon who was consulted in a case of retention of urine unaccountably

* Vid. Cheselden's *Anat.* p. 161, and Haller *Element. Physiol.* T. 7. p. 80.

the end of a month he was killed, but I was unable to discover a cicatrix.*

EXPERIMENT E.

An incision of small extent was made in the belly of a dog, so as to expose a portion of the small intestine, in which an opening was made that admitted the large end of a silver blowpipe. A piece of omentum, protruding with the gut, was cut away. The latter was softly replaced within the wound, which was now closed by suture. The ani-

mistook it for a suppression, requiring the operation of cystostomia. Among other palliative means of relieving the supposed dysury, gruel glysters had been resorted to. The operation was performed above the pubes, and a pint or more of water-gruel having a slightly fæcal odour was actually evacuated by the canula, to the mute astonishment of the beholders. The wound was then closed and dressed. Some hours afterwards the patient passed his urine with perfect facility, and experienced as little inconvenience as advantage from the tapping of his intestines.

* This experiment was twice repeated, but proved fatal in a few hours from hemorrhage, which, in both instances, was accompanied by fæculent effusion. In one the bowel was almost divided, in the other about half.

mal appeared to suffer nothing for some hours; but afterwards vomited and refused food. On the third day he ate and drank heartily, and in a week was perfectly recovered. I then killed and examined him. The injured fold had receded from the wound, though it was connected by a little band of lymph to the peritoneum at that part. On laying open the bowel, the aperture was discovered, of its original dimensions, but completely covered by the lateral adherence of the sound fold which lay nearer to the abdominal muscles. A probe passed into it took an oblique course between the two folds, under a delicate stratum of lymph which connected them.*

The following were the appearances presented on inspection of the abdomen in the case recorded by M. Littre,† which will serve as a proper sequel to these experiments. 1. The middle lobe of the liver, on the right side of the epigastrium, adhered firmly to the

* Vide Plate II. Fig. 1. † See page 21.

peritoneum. This adhesion was formed by a cicatrix three lines long, common to the two parts and corresponding with one of the integuments. 2. Two portions of jejunum situated beneath the stomach, *were fastened together on the side by which they touched.* Having detached them, a cicatrix was observed in the left fold, three lines and a half long, and two-thirds of a line in breadth, of a direction transverse to the length of the body, and corresponding in dimension to that of the skin, which was opposed to it. *No cicatrix appeared in the right fold to which that of the left was adhering, so that the latter only was wounded.* 3. In the anterior surface of the colon adjoining the right kidney, appeared a very oblique cicatrix, five lines long, and one and a half broad. There passed from this scar eighteen or twenty filaments of lymph, varying in diameter, through a corresponding cleft in the peritoneum and abdominal muscles, which terminated in the cicatrix of the integuments.

From these details it appears, that fur-

ther essential advantages are derived from the absolute fulness of the abdomen: that it not only prevents effusion, but provides the means of restoration: that the process of spontaneous reparation essentially depends upon the indefinite extension of the peritoneum, (by which membranous surfaces identical in their organization and properties are every where opposed,) and upon its disposition to assume the adhesive inflammation. Thus, if a bowel be wounded lying in contact with the peritoneum of the muscles, it repairs itself by the mutual adhesion of the cut surfaces;* another, more distant from the parietes, contracts a close adhesion with the contiguous fold, or lays hold of the adjacent omentum.†

* The appearance of membranous filaments or bands results from the elongation of the effused lymph, while in a soft or ductile state, by the motion of the parietes and the viscera upon each other, an appearance more frequently exhibited by the pleura.

† “It does not seem necessary” says Mr. Hunter, “that both surfaces which are to be united should be in a state of inflammation, for the purpose of effecting an union; it appears only necessary that one should be in such a state, which is to

If the wound is an orifice from loss of substance, it is never obliterated by the deposition of new matter, but by the permanent close adhesion of the surface applied to its margin ; if on the contrary it is simply a division of substance, as in a clean cut wound, the sides may unite *per se*, without contracting any surrounding adhesions, as happened in the instance of the sailor before mentioned ; in which case it appears probable that the cicatrix will escape detection.*

The following histories, abridged from Ravaton, of wounds unattended by fæculent discharge, will derive, I trust, additional interest from the insight which these experiments have afforded into the process of spontaneous reparation.

CASE I.

A lieutenant of the Lorrain regiment of infantry was pierced through the body with

furnish the materials, viz. to throw out the coagulating lymph, and the opposite uninflamed surface accepts simply of the union, p. 252.

* Exper. D.

a sword, 15th June, 1735. The wound by which the sword entered, was situated at the anterior margin of the right hypochondrium, the counter opening in the middle of the quadratus lumborum of the left side. The patient was in a state of extreme agitation : his wounds were covered with a plaister, compresses, and a bandage to support the whole ; and he was afterwards twice bled in the arm. He voided the same night two pots-full of blood per anum. On the morrow he was more composed ; but Ravaton repeated the bleeding, directed glysters of milk to be injected, put the patient upon a strict spare diet, and prescribed a vulnerary infusion for his ordinary drink. In the evening he had much fever, and was violent throughout the night. On the 17th his skin was universally tinged of an orange yellow, the integuments of the belly ecchymosed, and the fever high. He was ordered a simple diaphoretic draught. He continued to pass small clots of blood by the bowels ; the glysters were persevered in, and the

belly anointed four times a day with oil of linseed : 18th, he perspired abundantly, and though strictly enjoined a very sparing quantity of liquids, had much exceeded his allowance : 19th, the belly appeared distended, and Ravaton communicated to his brother officers his fears that he would die. Being urged by them not to quit him, the presence of his surgeon prevented the patient from drinking, and after a copious discharge of urine, the tension of the abdomen subsided. Unfavourable symptoms, nevertheless, prevailed till the 25th. The wounds suppurated sparingly, and the jaundice increased : 26th, the fever abated, and the patient complained of hunger. He took the yolks of eggs in broth, and some medicine designed to carry off the floating bile by the kidneys : 27th, the fever left him : 28th, the wounds were healed and the ecchymosis dissipated. In a few days the patient took his leave, though still very feeble, and with a yellow complexion. Ravaton ex-

presses his surprise, that so large a quantity of blood should be discharged without effusion into the abdomen. He attributes the jaundice to the læsion of the duodenum.

CASE II.

A serjeant of the grenadiers of Alsace was brought into Ravaton's hospital, on the 6th of August, 1745. He had been shot through the belly; the ball taking a direction from the right lumbar region to the left flank, where it escaped at the junction of the external oblique with the quadratus muscle. He was much dejected, his pulse oppressed, and his visage cadaverous. He was twice bled, and the wound superficially dressed. The belly was fomented thrice a day, and he was ordered a strict diet, a vulnerary infusion for ordinary drink, and a broth glyster, night and morning. For ten days little change took place: he was then seized with diarrhæa: the glysters were discontinued, and he took a grain of opium at

night. The purging continued notwithstanding for seven days. On the 18th day from his admission, he had no fever or tension of the belly, which rendered further bleeding unnecessary; but the fomentations were persisted in: 28th day, he was allowed to take the yolks of eggs in broth, soon afterwards rice, and a more nutritive diet. The sloughs had long since separated; the granulations looked healthy; and on the 63d day the wounds were cicatrized.

On the seventy-eighth day from his admission he left the hospital perfectly re-established; and had made two campaigns in Flanders when his case was published.

CASE III.

A lieutenant of marines, who had received a penetrating wound by a pistol-ball in the right lumbar region, was brought to Ravaton on the 5th of May, 1744. The wound had already been enough dilated,

and the patient was exhausted by repeated bleedings. He was allowed broth, and took a vulnerary ptyisan; the wound being dressed with digestive ointment, and the whole belly fomented twice a day. His pulse was good, and he was free from fever. He was placed in a position to facilitate the discharge of matters from the abdomen. For ten days all went on well: 11th, he was feverish: 12th, a painful induration appeared in the right iliac region. Laxative glysters were administered: they induced stools, but the hardness remained. Emollient applications were made to the part, and he was ordered a diaphoretic medicine: 15th, a violent purging came on, which carried off the fever, but much debilitated the patient. It appeared from the confession of his valet, that he had indulged his appetite for several days, and these were the consequences of his indiscretion. Ravaton remonstrated, and he abstained from solid food. On the

21st, a wedge of lead, of the thickness of the little finger, an inch and a half long, was voided by the rectum. His sustenance was now gradually increased, and the looseness which had till this time continued, ceased. The suppuration was copious until the 40th day, when it began to diminish: the wound granulated and contracted daily, and being perfectly cicatrized in two months and seven days thereafter, he returned home for the recovery of his health. "This observation," says Ravaton, "clearly proves the læsion of the intestine by the evacuation of the slug; but how happens it that the chylous or fæcal matters were not shed into the cavity of the abdomen? That no hemorrhage supervened? And by what good luck was the lead lodged within the bowel? This point may well occupy the attention of those who study the animal economy."

These cases I have introduced as practical exemplifications in detail, of the facts insisted upon in this and the preceding chap

ter. They prove that effusion is not an ordinary consequence of penetrating wounds; and that reparation is a process which may be looked forward to with as much confidence in the wounds of the intestines as in those of other parts, subject of course to the same exceptions, from the influence of collateral causes. I do not think that I could have strengthened my argument by accumulating cases; though if the reader should differ with me in this opinion, the records of the profession afford him abundant opportunity.

Having thus shewn that the apprehension of intestinal effusion in penetrating abdominal wounds is in the majority of cases without foundation, unsupported equally by theory and experience, I proceed to consider those consequences of the injury in which its real danger commonly consists. It will be observed in the examination of the records on this subject, that while one class of cases presented so little derangement of the natu-

ral and vital functions as to induce the belief that the bowels had escaped uninjured, in another class the symptoms were of such urgency and danger as to render the patient's recovery unexpected and surprising. Now by whatever difference in the circumstances of the injuries, or the constitutions of the patients, these opposite results might be explained; the inflammation of the peritoneal surface in the one class, and its absence in the other, is, I doubt not, the real cause of the distinction. Every wound is followed by inflammation, varied in strength and degree by the influence of occasional causes. The inflammation set up by an incised wound of the peritoneum, is the same as follows this wound in the integument of the body, terminating in the union by adhesion. The capillaries opening upon the cut edges pour forth a glutinous cement, which becomes the medium of inosculation between them. This purely local process so rapidly and with so little effort obliterates the injury, that it excites

no alarm, awakens no constitutional sympathy, and appears to be effected with as little disturbance in the abdomen as in the less important parts of the system.* But it sometimes happens, whether from the extent of the injury,† the læsion of nerves, a bad state of the habit or other cause, that the inflammation, instead of being restricted to the lips of the wound, extends over the continuous surface of the peritoneum. An universal congestion takes place, and the overloaded vessels relieve themselves—first, by an exhalation of serum, and secondly, by an effusion of coagulable lymph. This inflammation is opposed in character to that last described, being a destructive, and not a salutary process. The former is the specific result of a wound wherever inflicted, and is accurately limited to

* See the observations on simple contact as a cause of this limitation of inflammation in Mr. Hunter's Treatise, p. 245 and 246.

† This appears to have been the cause of death in the case of an officer shot in a duel in Hyde Park, and attended by Mr. Hunter; the details of which case forcibly illustrate all that has been said on the subject of effusion, and might, if it had occurred to my recollection, have been introduced with advantage at page 21.

the sphere of the injury. The latter is the result of irritation, by whatever cause excited, and spreads by continuity of surface.*

Constitutional disposition, we know, influences in a very sensible degree the character of a local inflammation in all parts of the body. This continuous inflammation is in some cases erysipelatous, and tending directly to gangrene, but when arising from local injury in a healthy subject, more commonly assumes a phlegmonous character, and proves fatal in the adhesive stage. Whether the circumscribed inflammation which glues up the wound is essentially the same as that which spreads by continuity to an indefinite extent, it is not necessary for me to inquire. The line of distinction is sufficiently marked by their respective events. The one is al-

* This spreading of the inflammation, Mr. Hunter says, is owing to continued sympathy, the surrounding parts sympathising with the point of irritation; and in proportion to the health of the surrounding parts and constitution, this sympathy is less; for we find in many states of parts, and many constitutions that there is a disposition to this sympathy, and in such the inflammation spreads in proportion. p. 277.

ways salutary, the other invariably pernicious. The wounds of the thorax and of the large joints exhibit the same phænomena. A topical inflammation producing adhesion at the point of the wound is necessary to repair the breach, and is unattended by constitutional derangement; inflammation spreading over the surface of the pleura or the ligamentous capsule is attended always with danger, and in the former case, generally with fatal consequences.

In the species of penetrating wound which we are now considering, two reasonable sources of apprehension exist: the one, an extravasation of blood, which if the gut be wounded generally admits of a fæcal effusion; the other, a diffused inflammation of the peritoneum.

In the first memoir of M. Petit, already referred to, will be found an excellent observation establishing the fact, that of an effusion of blood into the abdomen the primary effect will be simply in the ratio of its

influence upon the heart, as in hemorrhages of other parts.* For although the presence of an extraneous fluid undergoing decomposition will inevitably become an exciting cause of inflammation, yet if the operation for the discharge of the fluid is resorted to when its presence can be ascertained, no such consequences are to be apprehended as ensue upon effusions from the intestinal canal or the gall and urinary bladders.†

Effusions of blood from large vessels generally prove fatal, by their volume suspending or interrupting the functions of life. I examined the body of a man who had received the contents of a loaded musket in his belly, since which he had lain in a state of deliquium; his pulse imperceptible, his skin cold and clammy. The cava had been torn across, and the abdomen was distended to the utmost with fluid blood. La Motte relates two similar cases; in one of which the

* Acad. de Chirurg. tom. i. p. 238. Obs. par M. D'Argeat.

† “Extravasation of blood will take place more or less in all penetrating wounds; and this will prove dangerous or not according to the quantity.” Hunter, p. 545.

vena cava, in the other, both the aorta and cava were opened by a sword. The subject of the former lived to the third day, the latter died on the spot. In neither instance had the sword wounded the viscera.* Garangeot has a case of ruptured liver, in which the patient died in one hour after the accident, and the abdomen was filled with blood.† A multitude of such cases is collected by Morgagni.‡

The complete effusions of bile, urine, or fæculent matter prove uniformly fatal, by their quality inducing a destructive inflammation.§ The symptoms of an effusion which oppresses the vital functions by its volume, or arrests them by inducing syncope, will be easily distinguished from those of an effusion which

* Obs. 104, and 105. lib. cit.

† Mem. de l'Acad. tome ii. p. 117.

‡ Alex. Trans. t. iii. l. 54.

§ Three cases of this description have lately come to my knowledge. Two of effusions of bile from the gall-bladder, and one of urine. The appearances which they present do not differ in character, but are of course somewhat varied, according to the stage of the inflammation. See some observations on effusion in the 'Medecine Operatoire' of M. Salatiér.

excites inflammation. The former indeed usually subside in death, before the latter are engendered. It would be difficult to determine the fact of fæcal effusion, perhaps in most cases impossible; and as the belief that it had taken place might damp the energies of the practitioner, it would be a dangerous refinement to attempt the diagnosis. The train of symptoms characterising a peritoneal inflammation, the result of a local injury, differs in many respects, from that which has been described as belonging to the puerperal peritonitis. Indeed few symptoms of the disease originating from the same cause, are not varied and modified in different subjects so as to prevent us from regarding them as diagnostic. In some cases the belly is distended, in others soft; in some it is acutely painful to the touch, in others it will bear a degree of pressure; the pulse is often small and rapid, but I have known it moderately full and not much exceeding its natural frequency. Distressing

nausea and vomiting, constipation, acute pain and restlessness are invariably present, and are perhaps the only symptoms which may be considered certain in their occurrence.

Inquiries into the nature, situation and extent of a wound of the abdomen, and the circumstances under which it was received, particularly the fulness or otherwise of the stomach, are chiefly important as they enable the practitioner to study with effect and follow up with advantage the operations of nature. It is almost needless to insist upon the impropriety of probing or dilating the wound, formerly a prevailing practice, and of applying adhesive straps and rollers round the belly, in place of warm emollient poultices and fomentations.

The remedies upon which I feel disposed to rely are few and simple. Total abstinence from solid food, and a drink easy of absorption, given in very sparing quantities and at long intervals, with a rigid preservation of the supine posture, are restrictions

which should be most rigorously observed, so long as any are indicated. The following case pointedly confirms the importance of these restrictions. A gentleman was wounded in a duel by a pistol-ball in the right hypochondrium. It was supposed to have entered the abdomen at the margin of the large lobe of the liver. The main part of the treatment consisted in confining him, without intermission, to the recumbent posture, and allowing him no other sustenance than now and then a wine-glass of barley-water, for ten days succeeding the accident. He recovered and is still living.

Injections, as Paré has well observed, should be administered, if at all, with great caution. One full bleeding might be advisable before the commencement of symptoms. To any more active treatment I should take the state of the stomach as my guide. The intimate connection and lively sympathy subsisting between the digestive and the vascular systems, render the pulse

an equivocal if not fallacious criterion of the morbid changes which are to ensue. But if the stomach is quiet, we have little to fear; if it can be tranquillized, mischief may be averted; it is not in a state to retain medicine, if medicine could be exhibited with a prospect of obtaining the end; but to this it is manifestly inadequate under the circumstances of the case. How then shall the irritation of this organ be appeased, which if it continues is a never-failing omen of destruction? I would answer, by the reduction of the system. Early, free, and repeated blood-letting, general and topical, is the main remedy upon which I place reliance.* Nor

* If it were necessary it would be easy to shew, that in the instances of recovery in which symptoms of inflammation had shewn themselves, blood-letting had been early resorted to and relied upon as the *unicum remedium*: and the highest authorities might be called in evidence of the fact, that its merits in such instances were not exaggerated.—“Sed summum remedium præbet larga missio sanguinis, quæ præsentem inflammationem tollere, futuram vero præcavere efficaciter solet.”—Van Swieten Comment: vol. i. sec. 320.

The whole management of these cases is thus concisely summed up in the words of the able annotator on Dionis:—

while the stomach retained its irritability, and the pain continued undiminished, would I be deterred from it by the variations of the pulse. The apprehension of reducing the power of the system below the means of reparation is futile. Under a state of active inflammation in such parts, the patient cannot long exist; nor if he could, would this state admit of the repair of an injury. I would not presume to dwell upon so self-evident a practice, if I were not assured by repeated observation that it is seldom vigorously employed; that these cases are too often considered hopeless, and nature abandoned to her own resources. I have seen blood taken from strong men labouring under acute visceral inflammation from a local injury, in smaller quantities than are usually considered sufficient to reduce an ophthalmia. To what other cause than that which I have

“ Les saignées faites les unes près des autres, la diete exacte, les fomentations emollientes sur le ventre, sont presque les seules ressources de l'art, soit pour prévenir ces symptômes, soit pour y remédier.”—Cours d'Operations de Chirurgie, revue par De la Faye. p. 84.

assigned, can be attributed such a fatal apathy in the practitioner ? If there be an example of inflammatory disease in which the lancet may be used with the least reserve, it is surely that in which we are prohibited by the nature of the injury, from employing the only other efficient means of depressing the energy of the vascular system.

I shall conclude this chapter with two cases of penetrating wounds, selected from the treatise of La Motte, which afford a strong negative confirmation of this doctrine, and a marked contrast to those of Ravaton.

CASE IV.

In December, 1703, a dragoon of the regiment of Aubigny received a sword wound in the lower part of the umbilical region, beside the *linea alba*. The wound was dressed with a tent, as usual, and a plaister. The patient remained tranquil, was bled in the evening, passed a quiet night, and was the

next day well. On the 4th day he was seized with vomiting; pain was felt around the wound, extending thence over the belly. Anodyne injections, which were administered on this account, gave him no relief. On the 5th day the vomiting was incessant, but the pain somewhat abated. The pulse became weaker from day to day, until the 7th, when he died. The ileon was found pierced in three places in the course of the wound, which terminated near the left kidney.

CASE V.

La Motte was requested to visit a gentleman who had eight days before been stabbed by a sword on the side of the navel. The wounded man was affected with excessive vomiting, although up to this time he had experienced no ill consequence of the injury. He had a slow, small, and sunken pulse, and died on the 10th day, to the great surprise of the surgeon who had attended him. A

large wound of the ileon appeared upon inspection.

Of the morbid appearances accompanying these wounds no information is afforded us. The inflammation ran its course unimpeded; the practitioners having been lulled into a fatal inactivity by the interval which elapsed before the developement of the symptoms. I consider the cases peculiarly instructive, as they demonstrate the occasionally insidious origin of the destructive inflammation, and the prominence of one diagnostic symptom. La Motte's reflection on this symptom betokens a nice discrimination. "It is," says he, "by no means extraordinary to see a wound in the belly produce vomiting, from the irritation which the wound excites; and to this inflammation succeeds, which being communicated to the contiguous intestines gives occasion to vomiting, as happened in the subjects of the preceding observations." Thus he discriminates the vomiting excited by temporary

irritation from that which accompanies inflammation; and seems aware of the essential difference between them, regarded as prognostics.

“ If the vomitings do not indicate danger they will not be permanent; nor will the pulse become slow, small, and sunken, (*enfoncé*) nor the patient sink without quickly rallying. Such symptoms are fatal, even if the intestine be not wounded; but if it be, at whatever period they declare themselves, the wound is mortal, as these cases prove.” He afterwards qualifies: “ I do not say that none escape who have the small bowels wounded, but I do say that this cure cannot be accomplished, except the wounded intestine is in contact with the wound of the integuments; the chance of contiguity between these parts offers, without exception, the only means by which the cure can be effected*.” He ventures this assertion upon

* Je ne dis pas qu’il n’échappe aucun des blessez qui ont les intestins greles percez ; mais je dis que cette guérison ne se peut

the strength of two “miraculous cures,” obtained by that process; one in the person of a girl who had an intestinal abcess; the other in that of a woman, whose intestine suppurated after the cæsarean section. The contents of this chapter render it quite unnecessary to offer a comment upon these bold assertions of M. La Motte; nor should I have transcribed them, but for the unequivocal testimony which they afford to the necessity and importance of the present inquiry.*

faire sans moïen, qui est lorsque l'intestin touche la playe qui est au peritoine aux tégumens; le hazard qui rend ces partes contigües est la seul moïen qui peut en procurer la guérison, qui ne peut jamais se faire autrement.

* It is right to state that Mr. John Bell, in his discourse on ‘Wounds of the Belly,’ has hypothetically anticipated some of the facts established in the preceding chapters.

CHAPTER III.

EXPERIMENTS SHEWING THE EFFECTS OF
EXTENSIVE WOUNDS OF THE INTESTINE.

To undertake to afford relief without having ascertained the circumstances which call for it, and the mode of relief which these circumstances enjoin, is to be the dictator, not the minister of nature. The examples of human malady are unhappily too numerous, in which the career of disease, from its outset to its termination, meets with little if any impediment from the interposition of art. But it should afford us consolation to reflect, that in the origin of medicine, such must have been the character of those diseases which are now under controul. It was at one time as little to be anticipated that dis-

eases then esteemed incurable would have yielded to certain remedies, as it is still impossible to determine the extent to which their beneficial administration may hereafter be carried. But it is unnecessary to multiply arguments for the diligent study of desperate and extreme cases, whether belonging to the department of medicine or of surgery. They furnish lessons of infinite value to the attentive and intelligent observer; and if it were imposed upon us by a physical necessity, to suffer every imperfectly understood disease to take its unbiassed course, that its obscure phenomena should be developed and philosophically analysed, there can be little doubt that the interests of science, and of mankind in the aggregate, would in the end be materially promoted. The defect of such opportunities of observation may in some cases be supplied by a series of experiments on brutes; in which, subjecting nature to every disadvantage and extremity that can occur in casualties incident to the human species, we

obtain satisfaction respecting events which are inevitable, and learn the means of security against those which are not.

Before adverting to the consequences of wounds inflicted upon the exposed intestine, it will be necessary to describe certain appearances which the wounds exhibit, depending upon the action of the bowel. If a gut be punctured, the elasticity of the peritoneum and the contraction of the muscular fibres open the wound, and the villous or mucous coat forms a sort of hernial protrusion, and obliterates the aperture. If an incised wound be made, the edges are drawn asunder and reverted, so that the mucous coat is elevated in the form of a fleshy lip. If the section be transverse, the lip is broad and bulbous, and acquires tumefaction and redness from the contraction of the circular fibres behind it, which produces, relatively to the everted

portion, the appearance of a cervix.* If the incision is according to the length of the cylinder, the lip is narrow, and the contraction of the adjacent longitudinal, resisting that of the circular fibres, gives the orifice an oval form. This eversion and contraction is produced by that series of motions which constitutes the peristaltic action of the intestines, as I had an opportunity of observing in the following experiment.

EXPERIMENT F.

An animal which had recently made a full meal was suddenly killed by a high division of the medulla spinalis. I immediately laid open the abdomen, and whilst the peristaltic action was strong, wounded the bowel in various directions. On cutting it

* These appearances, of which some professedly practical writers have shewn themselves disgracefully ignorant, have also been described by Haller. *Element. Physiol.* lib. 24, sect. 2. 'Revolutio,' and *Opera Minora*, tom. 1. sect. 15.

across, eversion of both orifices took place, and they were instantly separated to a considerable distance. The contents, in part ejected at the moment of eversion, were restrained and in a slight degree absorbed by a succeeding contraction of the orifices, which was followed by a dilatation and simultaneous propulsion of the aliment; again the orifice was closely contracted and the matters arrested; and thus was the tube alternately opened and closed by the muscular motions of the bowel. At the moment of dilatation the contents were thrown out with a spasmodic jerk, and the everted lip gained in breadth as the motions increased in number. The edges of the longitudinal wound were less fully everted, but the divided fibres, drawing them in opposite directions, made the aperture approach to a circular figure, so that the contents issued very freely. There was little alternate contraction and dilatation of this aperture. The punctured wound everted irregularly, it had no even marginal

lip, but the mucous coat instantly filled the opening, and was elevated somewhat above the peritoneal surface ; it was the only form of wound not followed by effusion. In the lacerated wound, the eversion was so slight as to be scarcely perceptible. As the peristaltic action became feeble, these appearances became indistinct, and when it had ceased altogether, a fresh wound underwent only a trifling enlargement from the elasticity of the peritoneal coat.

Having witnessed the facility with which considerable læsions of the intestinal tube were repaired, I was solicitous to ascertain more fully the powers of nature in the process of spontaneous reparation ; to determine under how great a degree of injury it would commence, and if it were effected, the mode of its accomplishment. For these purposes the following experiments were instituted. I shall relate their results concisely, where the uniformity of appearances renders particular description superfluous.

EXPERIMENT G.

The intestine of a healthy dog, which had taken food two hours before, was divided to its mesentery, and the sections instantly replaced in exact opposition. The external wound was closed by suture: Shortly the respiration of the animal was observed to be hurried; and he vomited and became faint as if from hemorrhage. At night he died.

Examination. An inflammation of the dotted petechial character, peculiar to the effusion of an irritating fluid, extended over the whole peritoneal surface. The sections of the gut were retracted to the distance of half an inch from each other, at the point farthest from the mesentery. The abdomen was occupied by a quantity of fluid blood mixed with much soft alimentary matter, and some particles of bone and straw. The stomach

was empty and corrugated; the upper portion of the bowel was likewise empty, and its villous coat inflamed as far as the pylorus. The cut extremities of the bowel were everted, the lower orifice of the canal loosely filled with fæculent matter, as if passing; the upper open, and as large as the eversion of the mucous coat would admit. The contents of the lower section escaped on the slightest pressure, and when mingled with it, did not alter the character of the fluid effused.

EXPERIMENT H,

was a repetition of the preceding, but the animal had not so recently fed. Immediately after the replacement of the divided parts, sonorous evacuations of air took place within the belly. The animal died of peritoneal inflammation in forty hours from the experiment.

Examination. The wounded gut was surrounded by a copious effusion of lymph. Fæcal matter presented at the orifices, which were situated as in experiment G. Splinters of bone and excrementitious matter were found among the intestines.

EXPERIMENT I.

The transverse section was repeated in an animal which had been kept for seven hours in a state of abstinence. The operation proved fatal in six and thirty hours.

Examination. The inflammation was diffused and vivid. The belly contained a quantity of a thin sanious serum, but nothing like intestinal matters appeared. The ends of the gut, concealed by surrounding adhesions, were separated, contracted, and everted to the utmost; and both orifices were totally obliterated. Each section presented a continuous smooth surface, the apertures being

sealed by a yellowish substance, much resembling curd or lymph. This proved upon closer examination, to be a portion of chylous matter, so firmly condensed in the orifice, that a stream of water injected by a syringe did not dislodge it. The intestines contained an abundance of the same matter. The diameter of the orifices, when this plug was washed away, did not exceed the tenth of an inch.

EXPERIMENT K,

was a repetition of the last under similar circumstances. The animal lapped freely of water, and took a little solid food on the morning of the second day; nevertheless he died on the day following.

Examination. The everted extremities were uniformly plain surfaces, as in the last experiment, and presented no vestige of an orifice. Although the bowel was considera-

bly laden above the division, no effusion had taken place.

EXPERIMENT L.

The intestine of a dog, which had fasted for some hours, was divided in three fourths of its cylinder. At the moment of sewing up the parietal wound, the animal suddenly struggled with such violence as to protrude a large part of the canal. The wound in the peritoneum was of necessity dilated, and the gut with some difficulty returned. By this accident a very active inflammation was induced, so that, the operation being done at noon, the animal was found dead at an early hour of the following morning.

Examination. The displaced bowels were glued together in a compact mass, adhering to the peritoneum, and a turbid serum was effused. The orifices of the everted gut were securely sealed by the chylous plug before

described. Here again, solid alimentary matter was present in some quantity above the section, not a particle of which had found its way into the abdomen. The injection of water by a syringe, and pressure of the gut between the fingers, was equally resisted as in experiments I. and K. The appearance of the cut surfaces is preserved in the plate *.

EXPERIMENT M.

Two hours after a full meal the small bowel of a dog was exposed, and half of its cylinder cut across. It was carefully replaced, and the wound closed: the animal appeared lively at the conclusion of the experiment. In an hour and a half from this time he vomited, and again a few hours after. Next day his appearance was natural, and he seemed not much averse to motion; drank several ounces of water, and evacuated dark fluid fæces in quantity.

* Pl. 2. fig. 2.

In the evening he changed suddenly for the worse, and died in fifty hours.

Examination. The usual appearances of inflammation were accompanied by a considerable aqueous effusion*.

On raising the omentum, two or three folds of bowel were discovered agglutinated with it at the site of the wound, and so enveloping the half divided gut, as to form a sac, in which its more solid contents were deposited. The sections were drawn asunder as much as the semi-division would admit. Both orifices though collapsed were complete; and on very slightly compressing the gut, the matters escaped.

EXPERIMENT N,

was a repetition of the last, in which the animal had been kept without food. On the ninth day following he died from

* This I conceived to be the fluid which the animal had taken in such abundance.

circumstances unconnected with the experiment, of which I was not previously aware. During the period which he survived he appeared sullen, and refused food.

Examination. The peritoneal surface was healthy, and the wounded intestine thus curiously enveloped. A pouch, resembling somewhat the diverticulum in these animals, was formed opposite to the external wound, on the side of the parietes, by the lining peritoneum, on the other side by the mesentery of the injured intestine, that intestine itself, and an adjacent fold which had contracted with it a close adhesion. The pouch, thus formed and insulated, included the opposed sections of the gut, and had received its contents, viz. a ball of hair which the animal had licked from the wound, bone, and other solid substances. The sides of the sac were smeared with faecal matter. The tube at the orifices was

narrowed by the half eversion, but offered no impediment to the passage of fluids*.

* Plate 3. Fig. 1. I have more than once repeated this experiment but have not succeeded in obtaining a parallel to its interesting result. The reader may not be aware that in performing such experiments, considerable difficulties present themselves. In cases of division it is not always easy to replace the dissevered parts in precise opposition. The omentum frequently protrudes in quantity before the gut, when if it be retrenched and returned, there is much risk of hemorrhage; if the whole of the protrusion be returned, it generally forms a hernia at the muscular wound and is either interposed between the sections, or forms complicated adhesions around them. I have not recorded such examples, as the circumstances appeared to preclude the possibility of restoration.

The duodenum is the only small intestine of the dog uncovered by the epiploon, which from its immediate continuity with the stomach, is not to be preferred as the subject of experiments. The bowel sometimes protrudes with such force and rapidity, even through a small wound, as to be with difficulty restrained, and in other instances does not appear at a larger opening, a difference determined by the resistance which the animal opposes. In an extensive prolapse, it requires much caution to prevent extensive adhesions, and the same consequences to an indefinite extent attend every attempt to bring forward the gut by artificial means. Such are some of the difficulties which foil the best concerted schemes of the experimenter, and render his unembarrassed operations more the result of accident than of skill.

EXPERIMENT O.

A ligature of thin packthread was firmly tied around the duodenum of a dog, so as completely to obstruct it. The ends of the string were cut off and the part returned. The abdominal wound was then closed, and the animal expressed no sign of suffering when the operation was concluded. On the following day he was frequently sick, and vomited some milk which had been given him. His respiration was hurried. Third day, his sickness continued and he vomited some bilious fluid. Fifth day, he passed a copious stool of the same appearance as the fluid discharged by vomiting. His sickness from this time ceased, and his breathing was natural. He took bread and milk, and drank abundantly of water. Seventh day, he had three similar evacuations and appeared well, eating animal food freely. Tenth day, he had a natural solid

stool of a dark color. On the fifteenth day his cure being established, he was killed.

Examination. The lacteal system was well displayed, the animal having fed recently. A portion of omentum connected to the duodenum was lying within the wound, and the folds contiguous to the strictured intestine adhered to it at several points. A slight circumferential depression was observed in the duodenum. The gut was then carefully laid open; the villi appeared turgid with chyle. This surface was more vascular and of a deeper color than usual. A transverse fissure marked the seat of the ligature. The edges of the sections were distinctly everted, and the appearance corresponded with that of the union by suture, hereafter to be described*.

From these experiments the following conclusions may be drawn.

* Plate 3. Fig. 2.

1. If an animal has recently taken food in quantity, effusion is the direct consequence of an extensive wound, more especially if the wound be near the stomach, or if it be followed by hemorrhage or the sudden extrication of air from the canal.

2. If food has not recently been taken, and the wound amounts to a division of the gut or nearly so, the eversion and contraction of the tube at the orifices prevent the escape of the matters.

3. If the wound amounts to a semi-division of the tube or nearly so, the effusion of the matters will not be prevented, because the eversion and contraction are partial; but if from emptiness of the bowel effusion is not an immediate consequence of the wound, the inflammation supervening agglutinates the surrounding surfaces, and forms a circumscribed sac which becomes the depot of the effused matters.

4. Where effusion has taken place, notwithstanding the ordinary eversion, either

the aperture is visible or the matters are loosely held within it, as in the moment of being voided : but where it has been prevented, as in the cases of division above related, the maximum of eversion and contraction, and the included coagulum of chylous matter have obliterated the orifices.

These experiments were made upon the small intestine, which explains the appearance of the chylous plug. But notwithstanding its uniformity, I attach no importance to this appearance, except as the coagulation proves the imperviousness of the orifice.

5. It is the tendency of the two portions of a divided bowel to recede to a distance from each other instead of coalescing to repair it, and consequently the only means of spontaneous reparation consist in the formation of an adventitious canal by the encircling bowels and their appendages. Now granting the most favorable circumstances under which such an injury could occur, viz. a state of emptiness of the canal, the infliction

of the wound without displacement of parts, and the consequent opposition of the cut extremities ; yet retraction must have place, there can be no contact in a single point of the divided surfaces, and consequently no support for the deposition of a connecting medium. Besides, the mucous coat, which is the part opposed to the surrounding peritoneum, is not disposed to the adhesive inflammation.


6. Where the tubular continuity is to a certain extent preserved, the obstacles to reparation are not absolutely insurmountable. Under the concurrence of favourable circumstances supposed, the canal may be eked out, though irregularly, by the coaptation of surrounding folds. In Experiment N such an event occurred. The difference in the circumstances of the case is obvious. Retraction is prevented, and the processes of eversion and contraction modified by the limited extent of the wound. If therefore the adhesive inflammation of the peritoneum

unite the contiguous surfaces, the effused aliment will be prevented from passing into the abdomen, and the animal may thus escape immediate destruction. But it is equally impossible in this as in the case of complete division for union to take place, except by the medium of surrounding parts; and whether in such a deviation from the original structure of the canal, the motion of the intestines forming the diverticulum would suffice for the propulsion of the aliment, and the deficiency of the secreting surface would permit of its progress, I have no evidence which will enable me to determine.

7. It is the retraction ensuing upon direct division which renders this injury irreparable. For if the division be performed in such a way as to prevent retraction, the canal will be restored in so short a time as but slightly to interrupt the digestive function. The result of experiment O confirms this inference. A ligature fastened around the

intestine divides the interior coats of the gut, in this effect resembling the operation of a ligature upon an artery*. The peritoneal tunic alone maintains its integrity. The inflammation which the ligature induces on either side of it, is terminated by the deposition of a coat of lymph exterior to the ligature, which quickly becomes organized. When the ligature thus enclosed is liberated by the ulcerative process, it falls of necessity into the canal, and passes off with its contents. It is much in this manner that the disease termed *Intus-susceptio*, in which one portion of the gut is enveloped and strictured by another, not unfrequently undergoes a natural cure. The adhesive inflammation preceding the separation of the disorganized part, forms a channel by which the slough is voided. A sphacelated hernia sometimes admits of a natural cure upon the same principle; the extremities of the living in-

* I have seen this effect produced by a fatal strangulation in the human intestine.



testine being retained in contact at the point of stricture, which is Nature's ligature, and there uniting. The edges of the villous coat being everted more or less as the mode of division favors or checks retraction, the fissure of course remains, and is not afterwards obliterated.

8. The circumstances inseparable from the performance of these experiments, are materially less favorable than those which attend casualties incident to the human subject. The displacement of parts which in the former it is seldom possible to prevent, will not occur in wounds inflicted upon the bowel *in situ*. A general inflammation of the peritoneum which in most of these animals proved fatal, is by no means the uniform consequence of an extensive wound of the bowel, with or without exposure. In Experiments G, H, and M, inflammation followed effusion. In L it was the result of very general and extensive displacement. In N and O no such inflammation existed;

and I have met with other instances in which the inflammation was accurately limited to the immediate vicinity of the wound. In cases unattended by effusion, it is probable that the destructive inflammation is to be considered as in part depending upon the irreparable nature of the injury, which must by a physical necessity prove fatal, if inflammation were not induced.

The following experiments exhibit the effect of a longitudinal wound of the intestine.

EXPERIMENT P.

An incision one inch and a half in length was made in the bowel of a dog. The wound of the integuments was closed by suture. The animal was scarcely affected by the operation, took food as usual, and had natural evacuations. He was killed at the end of a fortnight.

Examination. The large intestine was enveloped in a portion of omentum, at its con-

nection with the concave edge of the spleen. The canal was contracted, and on carefully laying it open, a fissure intersecting the rugæ was discovered. Its length, viewed from within, was little more than half that of the incision. A small string of coagulated blood was contained in the fissure, the edges of which retained a slight eversion.*

Mr. William Cooper, in the 18th vol. of the Philosophical Transactions, relates the following experiments to determine the efficacy of a styptic powder. “A large dog being provided, an aperture was made through the common integuments of the abdomen, whence the small guts were extended; after an incision made in one of them according to its length, they were again reduced, the wound in the abdomen being stitched up, &c. The dog recovered without any ill symptoms, and became perfectly well in a few days after. The like experiment,” he adds, “I have since made upon another dog, who in like

* Plate 3. Fig. 3.

manner recovered without the application of any medicine *."

These experiments demonstrate, that wounds in a direction parallel to the canal are spontaneously repaired with more facility than those which are perpendicular to it. This fact is not inconsistent with the conclusions already made. The process of eversion being very limited, the aperture bears a smaller proportion to the cylinder of the bowel, and the action of the divided circular resisted by the entire longitudinal fibres, but slightly diminishes the area of the canal. Thus the aperture is more securely defended, and the adhesive process speedily repairs the injury. It should be observed however, that this form of wound is *cæteris paribus* not less disposed than others to effuse the contents of the intestine, as I have ascertained by experiment.

* An Account of some Experiments by Mr. Wm. Cooper, Surgeon. Feb. 1694.

CHAPTER IV.

EXPERIMENTS SHEWING THE OPERATION
AND EFFECT OF LIGATURES AND SU-
TURES.

WE have now arrived at a stage of this inquiry, in which we may form a tolerable idea of the resources of nature in the repair of intestinal læsions. Abundant examples have been adduced in refutation of the ancient dogma, which asserts the universal fatality of wounds inflicted upon the small intestine,* and on the other hand, the consequences of extensive læsions of continuity have been exhibited in a view sufficiently serious, to vindicate the apprehensions which they have never failed to excite.

* Hippoc. lib. 6. Aphor. 18.—Lib. 1. de morbis.—Coac. Prænot. &c. &c. ‘Si tenuius intestinum perforatum est, nihil profici posse.’ Celsi Med. Lib. 7. Cap. 16.

We have already seen in what degree injuries of the intestines can be sustained, and by what means they are occasionally counteracted; how far the process of spontaneous restoration extends, where it is overpowered, and only the vestiges of destruction appear. We are now to enter upon the more practical consideration, whether the information derived from experiment can be advantageously applied to a useful purpose, or in other words, whether the subservience of Art will afford support and scope to the exertions of Nature.

It has been shewn in a preceding experiment, that a considerable wound in the exposed intestine was speedily and effectually closed by the consequent inflammatory adhesion of the contiguous fold. I was desirous to know how the mode of reparation would be influenced, if a ligature were made upon an aperture in the paries intestinalis. With which view I made the following experiment.

EXPERIMENT Q.

Having exposed the intestine of a dog, a silk ligature was applied so as to include a considerable portion of the coats of the gut, and the included portion removed by the scissars. The ligature was left in the external wound which was closed by suture. In two days the animal recovered his appetite, and appeared as well as before the operation. At the end of a fortnight he was killed.

Examination. The peritoneal surface was natural; some slender filaments of lymph passed from the cicatrix to the adjacent intestine, and two convolutions of the bowel closely invested the wounded fold. On laying it open, the knot of the ligature appeared, loosely filling the orifice and discoloured by the fæcal matter. The adhesion of the covering fold was too close to admit of its being raised entire, notwithstanding the intervention of the ligature.

The mode of reparation in this case is precisely analogous to that which takes place in a punctured wound, or an aperture from loss of substance in the coats of the gut, where the ligature is not employed: viz. by a close adhesion of the contiguous fold, the internal orifice remaining.*

I should observe that in this case the ligature must have fallen into the canal if it had not been confined by the adhering folds. Its removal, where it is left long, and depending externally, must always be tedious, and the healing of the outer wound be in the same degree retarded. In such a case all the advantage of the ligature is obtained, and this inconvenience avoided by cutting the thread close to the knot, as was done by Mr. Cooper, at Guy's Hospital. While performing the operation for a strangulated hernia, an aperture giving issue to its contents was discovered in a

* Plate 4. Fig. 1.

portion of the sound intestine, just previous to its return into the abdomen. The operator including the aperture in his forceps, caused a fine silk ligature to be carried beneath the point of the instrument, firmly tied upon the gut, and cut close. The part was then replaced and the patient did well.

I shall now inquire into the operation and effect of sutures in extensive wounds of the bowel, as they are deducible from experiment.

Moebius, who gave the first relation of Ramhdor's operation in his thesis, read before Heister, at Helmstadt, 1730, * attempted to repeat that experiment, but without success, on a dog : the contractile strength of the fleshy fibres, and the comparative smallness of the canal rendering the insinuation of the upper within the lower portion of the tube impracticable. He therefore contented himself with sewing together the divided parts, but union did not take place,

* Haller. Disput. Anat. vol. vi. Obs. Med. Miscel. 18.

and the animal died of a fæcal effusion. Louis attributes Moebius's failure to his having omitted to cut transversely the mesentery attached to the superior extremity, a method of proceeding which, he says, makes the operation easy and secure. It does not appear however that Louis succeeded in repeating upon the dog the operation of Ramhdor, and the representation of Moebius has been since confirmed.

Shipton, an english student of surgery, in the early part of the last century made the following experiment.

Having cut away a portion equal to two fingers breadth of the ileon of a dog, he connected the extremities by an uninterrupted suture, and closed the external wound. The cicatrix being completed, and the parts examined at the end of three weeks, the result proved highly curious. The sewed intestine lay at a considerable distance from the wound, firmly attached to the peritoneum, but the suture had yielded so as to allow the cut ends of the gut to recede, which were

enveloped in a sac formed of adhering omentum and intestine. The following are the writer's words.

‘ Ad cicatricem ab internâ parte accuratius lustrandam, intestinum juxta longitudinem incidimus, quo ex uno latere vulneris labia adducta, ex altero eadem divisa proximisque adjacentium intestinorum partibus agglutinata fuisse apparebat, ita ut exteriores eorum tunicæ internum ab isto latere efformantes parietem, intestinalem fistulam continuarent, cibisque devehendis commodè inservirent*.’ The appearances described and delineated by Shipton bear a pointed resemblance to those of experiment N. The divided parts were retained in the one case by suture, in the other by the continuous portion of the tube in opposition, though not in contact. In both, the interval of the orifices was a sac formed by the adherence of surrounding parts,

* Philos. Trans. vol. xxii.

which received the intestinal matters. In Shipton's experiment the artificial canal was more uniformly cylindrical because the division was complete, in my own it was irregular because the section was partial.

Reflecting upon these results and unacquainted with the precise nature of the union by suture, I was induced to believe that simple apposition obtained by the least possible interference, would suffice for the purpose of restoration. To determine which point,

EXPERIMENT R.

I divided the small intestine of a dog which had been for some hours fasting, and carried a fine stitch through the everted edges, at the point opposite to their connection with the mesentery. The gut was then allowed to slip back, and the wound was closed. The animal survived only a few hours.

Examination. The peritoneum appeared highly inflamed. Adhesions were formed among the neighbouring folds, and lymph was deposited in masses upon the sides of the wounded gut. This presented two large circular orifices*. Among the viscera were found a quantity of bilious fluid, and some extraneous substances, and a worm was depending from one of the apertures. By the artificial connection of the edges in a single point of their circumference, and their natural connection at the mesentery, they could recede only in the intervals, and here they had receded to the utmost. The suture prevented the contraction of the circular fibres, from the obliquity produced by the more powerful action of the longitudinal between the two fixed points. All circumstances therefore combined to facilitate effusion, the obvious cause of the quickly destructive inflammation.

* Plate 4. Fig. 2.

EXPERIMENT S.

I increased the number of points of contact by placing three single stitches upon a divided intestine, cutting away the threads and returning the gut. The animal refused food, and died on the afternoon of the second day.

Examination. Similar marks of inflammation presented themselves. The omentum was partially wrapped about the wound, but one of the spaces between the sutures was uncovered, and from this the intestinal fluids had escaped. On cautiously raising the adhering omentum, the remaining stitches came in view. Here again the retraction was considerable, and the intervening elliptical aperture proportionally large *. On the side next to the peritoneum however, the edges were in contact and adhered, so as to unite the sections at an angle.

From these experiments it appears that apposition at a point or points is, as respects

* Plate 4. Fig. 3.

effusion, more disadvantageous than no apposition at all; for it admits of retraction and prevents contraction, so that each stitch becomes the extremity of an aperture, the area of which is determined by the distance of the stitches.

The following experiments, extracted from the thesis of Dr. Smith of the Philadelphia Medical Society, (which I had not seen until after these experiments were made) serve so strongly to confirm this fact, that I do not hesitate to present them to my reader.

EXPERIMENT IX.

April 16.

“ Having divided the intestine of a dog transversely, I attempted to treat it in the manner spoken of by Mr. Ramhdor, viz. by introducing the upper extremity of the divided intestine within the lower. After having procured a piece of candle, as directed by him, it was inserted into that portion of intestine which was supposed to

be the uppermost. I then endeavoured to introduce the superior within the inferior, but the extremities of each became so inverted, that it was found utterly impossible to succeed: it was therefore given up and treated in the way recommended by Mr. Bell, using only one stitch, and fastening it to the parietes of the abdomen. The dog took food the day after. On the 20th it was observed that the fæces were discharging at the external wound, when the animal appeared very weak, but still continued to take food. On the 21st he was much worse, and the abdomen being tense, the ligatures at the external wound were removed, to facilitate the discharge of the fæces, which gave a temporary relief. On the 22d he died. On examination there was found *a considerable quantity of fæces and water in the abdominal cavity*; one part of the intestine had united to the external wound, by which part the fæces were discharged.

EXPERIMENTS X and XI.

April 28.

Wishing to give Mr. John Bell's method a fair trial, I made the following experiments. Having obtained two full-grown dogs, a transverse incision was made into the intestines of each of them, which was secured by one stitch, and fastened to the wound. No. 10 died in about twenty four hours. The marks of inflammation were very great, *and the fæces had been discharged into the abdomen.* No. 11 died on the 2nd of May. The intestines appeared very much inflamed; *fæces, as in the other instances, were found in the abdomen, also water which the animal had drank.* The large intestines appeared gangrenous, and tore very easily."

From these experiments it results, that the absolute contact of the everted surfaces of a divided intestine in their entire circum-

ference is requisite to secure the animal from the danger of abdominal effusion.

If the interrupted suture is employed, it is therefore necessary to include such a portion of the everted lip, as will ensure this contact. This precaution indeed is important to be observed in every description of suture; for the eversion is permanent, and if the threads are passed as near as possible to the edges, with a view to overcome the eversion, effusion is to be apprehended from laceration of the included substance of the gut.

In the account of experiment R it is stated that lymph was deposited in masses upon the sides of the wounded bowel, as if to furnish an obstacle to effusion. In the second, S, the deposition was prevented by the adhesion of the omentum. I have noticed this appearance upon similar occasions. The lymph generally bears a proportion to the dimensions of the aperture; but it has no

connection with the mucous coat, and offers no impediment to the escape of the matters. The appearance of coagulable lymph *en masse* is the sign of a vehement, not a healing action,* and is uniformly prevented by the contact of cut surfaces, in which event it assumes the form of membrane, the only one susceptible of rapid organization.

I shall now refer to the experiments of Mr. Astley Cooper, Dr. Thomson, and Dr. Smith, that my reader may be in full possession of the fact of restoration, before I offer an illustration of the process.

Mr. Cooper repeated the experiments of Duverger, who had succeeded in uniting by suture the divided intestine of a dog, including in it a portion of the trachea of a calf. In place of the uninterrupted

* This fact is conspicuously exemplified in the adhesive inflammation of the iris and anterior chamber of the eye in vehement acute ophthalmia.

suture, three distinct stitches were inserted. On the sixteenth day the animal was killed, and the union was complete.

He then made the experiment without including the foreign substance. On the second day the dog took food and on the fifth the ligatures were drawn away, after which he suffered nothing from the experiment. In both of these cases, it should be observed, the intestine rested against the wound and was confined there, the ligatures depending externally*.

To Dr. Thomson, Regius Professor of Military Surgery at Edinburgh, we are indebted for the following curious and important additions to our knowledge of this subject. After the transverse section of the small intestine of a dog, five uninterrupted stitches were applied at equal intervals, the ligatures cut close, and the external wound sewn. On the tenth day the animal was killed.

* Cooper on Hernia, Part I. ch. 11.

A portion of the intestine, more thick and vascular than usual, adhered to the wound of the parietes, but the line of division was imperceptible on the outside of the intestine. On slitting it open, it was discovered that three of the stitches had disappeared, but the place of their former attachment could be distinctly perceived on the *inner* surface of the bowel.* Two threads were still adhering to the wound. Finding that the thread had passed from the outer to the inner side of the intestine, Dr. Thomson repeated the experiment, allowing the animal which was the subject of it, to survive six weeks. Upon inspection no distinct mark of division appeared externally, but on inverting a portion of the gut, two stitches were found adhering to its inner surface. The remainder had been discharged, but the traces of them were yet visible. The portions of the gut included in the remaining ligatures were

* Plate 5. Fig. 1.

obviously vascular, so that it is difficult to say when the ligatures might have separated.*

Dr. Smith repeated the experiments of transverse section and suture with similar results, using only four stitches at equal intervals. In one case he previously excised two inches of the intestine. It is to be regretted that this gentleman has in every instance overlooked or omitted to describe the anatomical appearances.

With a view of ascertaining the comparative facility of union in longitudinal and transverse divisions, Dr. Thomson performed two other experiments. He made an incision into the bowel of a dog, an inch and a half long, opposite to and parallel with the mesentery. In one case four stitches only were applied to the cut edges, in another the intervals of the stitches were sewn up with a fine thread. The threads

* Plate 5. Fig. 2.

were cut close to the knots by which they were fastened. In both instances tension of the belly succeeded, the animals became uneasy and shewed an aversion to food, and in less than forty-eight hours died. On inspection, strong marks of peritoneal inflammation were apparent, the edges of the wound were torn asunder, and a copious effusion had taken place, consisting partly of inflammatory exudation, and partly of intestinal matters.

Mr. Cooper repeated this experiment, substituting the uninterrupted suture for stitches. The symptoms were so severe as to render the animal's recovery for some time doubtful. On the seventh day he was killed. The intestines were glued together. On cutting open the injured fold, the threads were seen loosely adhering to the edges, and the knot made upon the outside was now hanging on the inner side of the bowel. Dr. Thomson, and afterwards Dr. Smith, repeated this experiment with success. The former

included only the peritoneal tunic in the suture. The dog was at first much indisposed, but recovered upon a spare diet, and was killed on the twelfth day. The ligatures, as in every instance, had passed from the outer to the inner surface. The latter gentleman again made trial of the interrupted stitches, applying six to a wound of two inches in length, and cutting them away at the knots. The animal took food in less than twenty-four hours, and continued well.

The fact of reparation by artificial connection of the divided parts being established, it remains only that I should point out the several stages of a process, which has not, to my knowledge, been described.* It commences with the agglutination of the contiguous mucous surfaces, probably by the exudation of a fluid similar

* It is not necessary that I should trouble my reader with a detail of similar experiments instituted for this purpose.

to that which glues together the sides of a recent flesh wound, when supported in contact. The adhesive inflammation supervenes and binds down the reverted edges of the peritoneal coat, from the whole circumference of which a layer of coagulable lymph is effused, so as to envelope the wounded bowel. The action of the longitudinal fibres being opposed to the artificial connection, the sections mutually recede as the sutures loosen by the process of ulcerative absorption. During this time, the lymph deposited becomes organized, by which further retraction is prevented, and the original cylinder, with the threads attached to it, are encompassed by the new tunic.

The gut ulcerates at the points of the ligatures, and these fall into its canal. The fissures left by the ligatures are gradually healed up; but the opposed villous surfaces, so far as my observation goes, neither adhere nor become consolidated by granulation, so that the interstice marking the

division internally is probably never obliterated.

An intestine treated by suture is always more or less connected by incidental adhesions to the contiguous surfaces; these may with some caution be detached from the peritoneal coat. Irregularities of the external surface from exuberances of deposition, seem to depend upon the partial or irregular apposition of the cut extremities; and the width of the interstice is determined by the more or less firm and complete contact in which the divided parts are held by the suture.

Although the substance of the paries intestinalis is ever after deficient in the line of division, yet by inspection of the external surface, it would be difficult, if possible to say, where the division had taken place even at a recent period from the injury.

In Plate V. the reader may see the progress of restoration at the periods of ten days, six weeks, and nearly three months from the suture.

It has been found sufficient for the purpose of union, to include only the peritoneal covering of the intestine in the suture, a proof that provided the severed extremities are fairly brought into contact, the event, under any circumstances, will be uniform. The adhesion which takes place between the mucous surfaces in a few hours after their connection by suture, is in no instance permanent, being destroyed by the retraction of the divided parts when the ligatures loosen. But if this retraction could be prevented, and the mucous surfaces were retained in contact, it is probable that no organised, and of course no permanent union could take place betwixt them; for the internal coat of the bowel is, as before observed, indisposed to the adhesive inflammation*. For this reason it is, that the

* I had been led to expect that the interstice of the villous coat would be filled by granulation, and that the substance of the cylinder would in this way be restored at the place of division. But finding the eversion of the villous edges uniform and permanent, it seemed doubtful if such a process could be set up, as perfect surfaces were opposed to each other. It is also not in-

ligatures invariably pass into the canal ; their separation externally would have interrupted the healing process, as we find to be the case in other parts to which they are applied.

I shall now briefly recapitulate the principal facts established by experiment in the preceding chapters, in the form of corollaries.

1. Effusion of the intestinal matters rarely takes place in penetrating wounds. The impediment to effusion consists, first, in the resistance which the mechanism of the abdomen opposes, and secondly, in the circumstances contingent upon and peculiar to intestinal wounds. By the former statement I mean the general contact and equal pressure before explained ; by the latter, the processes of eversion, contraction, and peritoneal adhesion.

2. Effusion of the intestinal matters more readily takes place from lacerated and ul-

consistent with the indisposition of the mucous surface to the adhesive inflammation to infer, that it does not readily admit of the granulating process, which is only an advanced stage of that inflammation.

cerated apertures, because in these the combination of the causes of impediment is destroyed.

3. The uniform contiguity of the peritoneal surfaces, and the ready disposition of these surfaces to assume the adhesive inflammation, are the means provided by Nature for the reparation of intestinal wounds and injuries.

4. By these means punctured and small incised wounds, transverse or longitudinal, and apertures from excision of substance, readily admit of spontaneous cure.

5. It is even possible under certain conditions that after a wound by which the intestine is half divided, the tube may be imperfectly restored upon the same principle; but wounds amounting to a *direct* division of the canal are irreparable, and therefore invariably fatal.

6. Where the division is *indirect*, as by the operation of a stricture, natural or artificial, the injury admits of speedy and perfect recovery.

7. Where a ligature includes a portion of the paries intestinalis, the process of reparation is precisely similar to that which takes place where no ligature is employed, viz. the adhesive inflammation margining the ulcerated wound in one case, and the simple incised wound in the other, attaches the adjacent peritoneal surface.

8. Ligatures of every description, unconfined at the external wound, separate into the canal and pass off with its contents: not from any law of the economy which has been adduced in explanation of some similar invariable phenomena, of which the cause was not obvious, but from their speedy and complete investment by the uniting medium.

9. The union of a divided bowel requires the contact of the cut extremities in their entire circumference, effectively to resist the muscular action opposed to an artificial connection during the process of union. The species of suture employed is of secondary importance, if it secures this contact.

10. The mode of reparation, adopted in those wounds of the intestines which are connected by artificial means, proceeds upon the same uniform principle as is exhibited in spontaneous repairs. But the effect is varied, inasmuch as retraction of the divided parts being in the former prevented, the cylinder of the intestine is preserved by a process of independent union, whereas in the latter the union is effected entirely by the medium of surrounding parts.

I need scarcely point out to my reader's observation the characteristic simplicity and uniformity of the operations of Nature evinced in these experiments.

The abdomen, in the simplest physiological view, presents a region of homogeneous surfaces, and a capacious excretory. The disposition of the former for the adhesive inflammation, and of the latter to afford an outlet to extraneous and disorganized matters, offer an explanation of the principal phenomena of its pathology,

CHAPTER V.

OF COMPLICATED WOUNDS ATTENDED BY
FÆCULENT DISCHARGE, BY PROLAPSE OF
THE BOWEL; THEIR TREATMENT.—OF
THE ARTIFICIAL ANUS AS A CONSE-
QUENCE OF WOUNDS.

IN a former chapter I examined the consequences of complicated wounds unaccompanied by fæculent discharge or prolapse of the bowel. I now proceed to examine the nature and effects of wounds in which the intestinal tube directly communicates with the surface, and the alimentary or fæcal matter is discharged by the parietes. Among the more frequent examples of this species is the perforation of the intestine by worms or foreign bodies, a process by which nature relieves herself, and which, though often preceded by symptoms of urgent suffering, is generally conducted through its stages

without hazard or consequent inconvenience. In some rarer cases however, where the intestine implicated has been nearly connected with the stomach, and the preternatural discharge was long continued, the system has gradually sunk from defect of nutriment; while in others the extensive ulceration of the integuments has given origin to an artificial anus. The citations in the note refer to examples which the reader, if he pleases, may consult, of such discharges of fruit-stones, bones, balls, pins, and other foreign bodies, together with excrementitious matter from various parts of the abdomen, which, as soon as the external wound healed, a period often not exceeding three weeks or a month, for the most part resumed its ordinary course, and left the patient well*.

* Hildan. Cent. 1. Obs. 54.—Ephem. German. Garman, Dec. 1. An. 1. Obs. 145.—Offredi, Dec. 2. An. 1. Obs. 126.—Grassius, Dec. 2. An. 5. Obs. 45.—Schelhammer, Dec. 2. An. 5. Obs. 10.—Hanneman, Dec. 2. An. 3. Ob. 55.—Schmidt, Dec. 3. An. 2. Obs. 156—Schenck. Obs. Med. Lib. 3. Obs. 230. 240.

The principal feature by which these wounds are distinguished from those before described, namely, the discharge of the intestinal matters, results from the size and apposition of the openings in the parietes and the gut. The symptoms are generally less imminent than of those in which the external communication does not exist, chiefly because the evacuation which takes place at the wound is a direct and powerful check upon the disposition to membranous inflammation which supervenes. The event of effusion being provided for, and the peritoneal inflammation rendered less probable or less formidable in its occurrence, the eventual importance of the case appears to turn

Mem. de l'Acad. de Chirurg. Hevin sur les Corps Etrangers, &c. Tom. I. p. 561 à 570.—Pipelet, Tom. IV. p. 171. Lamzweerde in Scultet. Armam. Chirurg. App. Obs. 68. p. 267—Wolfius Act. Nat. Curios. T. 7. Obs. 129.—Petit. Traité des Malad. Chirurg. T. 2. p. 225.—Amyand, Phil. Trans. Vol. 39. 1735. Obs. 4.—Cole, Edinb. Med. Essays. Vol. 5. Art. 35.—Latta's Surg. Vol. 3.—Portal, Cours d' Anat. Medic. Vol. 5. p. 240. &c. &c.

upon the restitution of the intestinal function.

To illustrate the subject, I shall lay before my reader the substance of some authentic observations, commencing with the examples of

Single Parietal Wound.

A Dutch sailor received a wound of the colon with a knife, struck into the belly above the right hip. The fæces passed by the aperture, which it was thought necessary to dilate. The discharge diminished daily, and in three weeks the wound was healed. During his confinement the man drank his daily allowance of grog, and continued to smook his pipe as usual*.

A soldier was wounded with a sword one finger's breadth below the navel. Although the wound was so small as to appear insignificant, the man complained of sharp pains in the abdomen, and was compelled to keep the recumbent posture. A surgeon who

* Stalp. Vanderwiël, Cent. 2. Obs. 25.

was called to him on the tenth day observed a slight oozing of a dark and very fetid fluid from the wound, and suspecting that the intestine had been injured, dilated it, and gave issue to a mass of indurated fæces. The intestine was left, as it was found, adhering to the peritoneum. This operation was attended with immediate relief. The discharge by the wound again gradually declined, and by the 19th day a perfect cure was accomplished*.

The following is an extract of a letter from Mr. Ronaldson, assistant surgeon to the Hospital in Canada, to Dr. Hope, of the University of Edinburgh†. “ One of the Indians here was lately wounded in a drunken quarrel, in a manner which I imagined would be very dangerous, but which in reality was not the case. He was stabbed with a knife on the left side, near the lumbar vertebræ, about half way be-

* *Observ. par M. Froumantin, Mem. de l'Acad. Tom. 1. p. 601.*

† *Duncan's Med. Comment. Vol. 7. 1780.*

tween the os ilium and the false ribs. There could not be the smallest doubt that the knife had penetrated into the colon, as fæces were discharged by the wound for near three weeks. He had however no symptom of any considerable degree of inflammation, and was completely cured in five weeks. He is now in perfect health, and able to undergo the fatigue of hunting."

A case from Desault's Journal, which affords a good model for practice, may without apology be stated somewhat more in detail. It is recorded by M. Fournier.* A young man was deeply wounded between the last ribs near their cartilages, by a knife. The wound, which was ten lines in breadth, bled freely, and he immediately vomited a part of his dinner, which he had just taken. A slight discharge of thick dark blood was observed to have a fæculent odor, when his injury was examined in the Hotel Dieu, two hours after the accident. The situation of the wound and the fetor of the discharge

* Journal de Chirurg. Tom. 3. 1792.

discovered that it was in the colon. A poultice was laid over the abdomen—the patient placed upon the wounded side, and prescribed a rigid diet and a pectoral emulsion. In the evening he vomited the remaining aliment which his stomach contained, and passed a pretty calm night, the wound discharging much grumous blood of a most offensive stercoral smell. Next day the pulse was risen in frequency, but neither full nor hard. He was bled from the arm—soon afterwards the pulse rose, the belly swelled, the edges of the wound were puffy, and the bleeding was repeated. The discharge upon the poultice increased in feter and fluidity.

During the second night a copious bloody stool was voided *per anum*, by which the patient was much comforted. Third day. The belly had a little subsided—some effusion appeared around the wound; the skin was hot, pulse strong and rapid, and thirst ardent. A third bleeding produced no sensible effect. Fourth day. A little fetid

sanies colored the poultice. There was much pain in the head; the pulse was natural. As no stool had been passed for twenty-four hours, a glyster in half the usual quantity was softly injected, of which a part flowed out of the wound. This was followed by three copious evacuations *per anum*, composed of thick dark blood and clotted matters. At night the fever returned; a fifth bleeding dispelled the pain in the head and procured five hours of refreshing sleep. Sixth day. Pulse natural; belly supple; margin of the wound florid, but not painful. A second injection, administered as before, escaped at the wound and was again followed by stools. The discharge at the wound was less abundant and less offensive. Seventh day. Water injected by the rectum made its way out at the wound, but the expulsion of air from the wound, hitherto habitual, ceased. From this day the dejections, which were excrementitious but mixed with blood, passed only *per anum*. Solid aliment was given in very sparing quantities. The

wound formed a firm cicatrix, and the man was discharged from the hospital on the 50th day from his admission, feeling no ill consequence of the accident.

Double Parietal Wound.

In these cases the sword or bullet has perforated the body. A soldier, in the military hospital at Metz, was run through the belly in single combat. The sword entered the right iliac and passed out by the left lumbar region. Until the seventh day the man concealed his wound from dread of punishment. Both wounds were then in a gangrenous condition. The situation of the wound, and the appearance of the discharge made it probable that the ileon was wounded by the entry, and the colon by the exit of the sword. The sloughs soon cast off, the lips of the wound became florid, and cicatrised in less than two months. This soldier had the indiscretion to eat some baked fruit on the evening preceding his in-

tended departure to join his regiment, in consequence of which he was seized with a violent colick, and died in six and thirty hours from the attack. Unfortunately no attention to regimen had been prescribed. The wounded ileon it appeared was somewhat diminished by the healing process, and had given way at the point of its adhesion to the peritoneum*.

The fatal effect of indigestible substances swallowed during the healing process is strongly exemplified in the following history. A groom whilst drinking in a tavern was transfixcd by a sword, which passed through the right loin to the opposite flank. For eight successive days, excrement passed freely by the wounds, and the case presented the fairest prospect of a favourable issue. The attendants, solicitous to restore the natural course of the aliment, caused the patient to swallow leaden bullets, by which they succeeded

* Louis. Sur la cure des hernies avec gangrene. Mem. de l'Acad. de Chirurgie. Tom. 3.

in procuring a copious evacuation *per anum*. But the symptoms suddenly changed, the evacuation was altogether suppressed, and on the sixteenth day he died. The following is an account of the dissection in the writers words*. “ L’abdomen etant ouvert exhala une très mauvaise odeur, car les excremens etant tombés par la playe de l’intestin (colon) dans la cavité du bas ventre, avoient causé la corruption et la gangrene des intestins, mais la plaie de l’intestin, ou ses levres s’etoient tellement reunies avec des levres de la playe de l’abdomen, qu’il fallut un couteau pour les separer ; et si la cavité de l’abdomen se fut vuidée *les premiers jours* par cette voie, les assistans assureroient avec moi que le malade auroit pu echapper, et on ne manque point de pareils exemples.” How the effusion had been induced, the exhibition of the *balles de plomb* sufficiently explains; the point at which it had taken

† M. Simon Aloysius Tudecius, Physician of Prague. Collect. de l’Acad. Roy. des Sciences, T. 3, p. 406. & Miscel. Curios. An. 9 & 10 obs. 121

place, if it really existed, appears unaccountably to have been overlooked. The favourable state of symptoms up to the tenth day is absolutely irreconcilable with the idea of primary effusion, and the firm adhesion of the wounded colon to the parietes is of itself sufficient to destroy the hypothesis. However the case may be explained, which the details leave unintelligible, there is much reason to presume that the officious interference of the surgeon was the real origin of the mischief, and that nature, left to herself, would have completed the work she had so well begun. Dionis has the following remark. “J’ai guéri plusieurs personnes à qui les gros intestins étant percés, les matieres fecales sortoient par la playe, en ne leur faisant prendre les premiers jours que deux cuillerées de consommé et un jaune d’œuf *.”

* Cours d’Operat. 2 Démonstr. p. 83.

An officer received a gun-shot in the hypogastrium, in battle. It appeared that the colon must have been extensively lacerated, the ball being of large diameter. For two months the excrement escaped at the wound, which in that time healed, and the patient was restored without deriving any assistance from the art of the surgeon.*

Three valuable observations of gun-shot wounds of the intestine accompanied by fæcal discharge will be found in the Memoirs of the Academy of Paris, related by M. Bordenave.

The first was a case of a peculiar kind, exhibiting what Mr. Hunter denominated the secondary symptoms of gun-shot wounds. It was a slough following a contusion of the colon at the end of twenty days, when all the symptoms of the injury had disappeared. The excrement at the

* Bellosté. Chirurg. d'Hospital, P. 3. Ch. 15.

same time issued at the wound, which was dilated, and a perfect cure was obtained in six weeks. A parallel to this case, in which the bowel was only contused by the ball, will be found in Mr. Hunter's chapter on gun-shot wounds. Three balls, it appeared, had passed through the body, entering on the left side of the navel, and passing out near the first vertebra of the loins. The urine first made after the accident was bloody, indicating a læsion of the kidney, but this symptom soon disappeared. In less than a fortnight Mr. Hunter pronounced his patient out of danger; but some days after, fæces escaped at the wound. "It was not difficult," says he "to account for this new symptom, it was plain that an intestine had only received a bruise from the ball, but sufficient to kill it at this part, and till the separation of the slough had taken place, that both the intestine and canal (of the ball) were still complete, and therefore did not communicate with each other;

but when the slough was thrown off, the two were laid into one at this part, therefore the contents of the intestine got into the wound, and the matter from the wound might have got into the intestine. However, this system soon ceased by the gradual contraction of the opening, and an entire stop to the course of the fæces took place, and the wound healed very kindly up.*”

The second of M. Bordenave's cases fell under the care of M. Geraud, at the battle of Fontenoy. The ball entered the left hypochondrium at the distance of four fingers' breadth from the linea alba, and escaped at the same distance from the spine on the opposite side. The arch of the colon was the part wounded. A stercoral discharge took place at both openings, which were dilated and dressed simply. Cicatrization of the wound and the ordinary course of the alimentary matters were established in five and thirty days.

* *Treatise on the Blood and Inflammation*, p 551.

The third observation is that of M. Pon-
eye, at the battle of Rancoux. The ball
entered midway between the umbilicus
and spine of the ilium on the right
side, passing out at the upper part of the
same bone. A draught composed of
almond oil escaped at the wound, having
a strong fæcal odor. The belly swelled
and fever succeeded. M. Poneye dilated
the wound, and in two days the aperture
of the gut and the epiploon appeared ex-
ternally. These parts were not re-introduced,
but simply dressed. At the end of ten
days the epiploon sloughed. As the wound
streightened, the gut gradually recovered
its situation, and the oozing from it ceased
entirely in a few days.

M. Larrey informs us, in general terms,
that he had seen the sigmoid flexure
of the colon in several instances wounded
and healed up without fistulæ. Of this
case were three examples at Acre, and
two at Cairo. It was M. Larrey's prac-
tice to dilate the wounds freely, both of

the entrance and exit of the ball, to inject frequently linseed glysters, and particularly to observe the diet and repose of his patient.*

Such and similar are instances of complicated intestinal wounds unattended by prolapse, of which I regret that my experience has not enabled me to present my reader with original narratives. They appear to me to authorise the following important conclusions.

1st. The intestinal aperture retains its opposition to the peritoneal wound.

I made the experiment of wounding the intestine to an extent sufficient to admit of a free discharge, without suffering it to prolapse. When the animal was killed, it appeared that the adhesive inflammation had glued the peritoneal edges so securely together, that it was impossible they should be dis-severed without violence. The peritoneal surface was at the same time perfectly heal-

* Relations Chirurg. de l'Armée d'Orient.

thy. I had many opportunities of witnessing the same fact at various periods from the injury.

2d. The free egress of matters by the wound prevents obstructions in the canal, and consequently relieves the patient from the local and constitutional disturbance, of which obstruction is a never failing cause.

I have uniformly found, and shall hereafter have occasion to state the fact in detail, that from wounds of the intestines in which their contents were freely evacuated at the parietal opening, the animal has expressed no sign of suffering, nor has the abdomen at any period presented an appearance of inflammation.

This is the essential practical distinction between the wound unattended by discharge, and that which communicates with the surface. In the former we have no means of drawing off the copious secretions of that part of the canal, which is situated above the

wound ; one of the most direct and powerful checks upon the energies of the system. Blood-letting is therefore our only resource. But in the latter species of wound, not only is a morbid accumulation of matters prevented, but by the quick discharge of the aliment the process of sanguification is so materially repressed, that we have rather to guard against the effect of exhaustion, than the excess of inflammatory action. This fact explains why the febrile commotion is comparatively slight in this class of intestinal wounds, why the belly is free from tension, and other marks of a peritoneal affection rarely appear, and why on the other hand, if the discharge be suddenly checked, these symptoms speedily present themselves. Hence doubtless has arisen the practice of dilating the wound, which though by no means a practice to be employed indiscriminately, in many cases, as in that of M. Froumantin, has preserved the lives of patients.

There is no point in the treatment of these injuries of equal importance with the proper regulation of this preternatural discharge. That within certain limits it is not incompatible with a state of robust health, has been proved in numberless instances: if therefore the system sustains the shock excited by the injury, it is not the life, but the comfort and convenience of the patient that becomes the object of our solicitude. I shall hereafter speak of the means by which this object may be best secured. I wish at present to confine myself to the fact, that a free discharge from the wound relieves, in a very striking manner, the urgent symptoms of inflammation in an advanced stage, and appears at an earlier period to prevent the accession of such symptoms.

The advantage gained by the evacuation in these cases, seems to be equivalent to that which is in others obtained by purgatives*; the irritation occa-

* See a case by Amyand, *Phil. Trans.* Vol. 39, 1735.

sioned by the retention of solid fæces in the large bowels, being at the same time removed by the use of clysters. M. Poneye appends a very sensible remark to the case cited on his authority. “Cet exemple sert encore à prouver combien en peut esperer de la part de la nature, *en l'aidant néanmoins un peu*, pour la guérison des hernies avec gangrene.” The instances of this species of complicated wound, which have proved fatal after the lapse of some days from the injury, are those in which the surgeon prematurely anxious to restore the original course of the matters, has abruptly closed, or failed to dilate the external wound when by the sufferings of the patient this step was indicated; from a very rude pathology has exhibited indigestible substances, or has been altogether inattentive to the patient's diet.

3d. The passage of the matters by the wound does not in any degree impede the subsequent efforts of nature to restore the canal.

This conclusion is warranted by a multitude of spontaneous cures of intestinal wounds and herniæ. As the healing process advances, the continuity is restored, and less effort is required to propel the matters along their natural channel, than in any other direction. But in this operation nature will not be hurried; every attempt to anticipate her is attended with imminent risque, and the ultimate stage of the process, the cessation of the artificial discharge, is soonest and most safely attained, where the primary evacuation is encouraged. The obvious reason is, that the actions of the part take their color from those of the system.

It is a mistake to explain the restitution of the canal upon a mechanical principle, as has been proved to the patients' cost in those cases where the opening has been prematurely closed; it depends upon the gradual recovery of the function of the the intestine, as the breach by which it was suspended, is repaired.

4th. The injury carries with it the means of redress, viz. an inflammation sufficient for its reparation.

If the wound be so small as not to admit of the stercoral discharge, the union by adhesion may take place at once; where the discharge exists, the wound is of course fistulous. The suppurating process must ensue, and should be encouraged until a clean and florid granulation, and a well conditioned secretion are established; then the fæculent discharge gradually diminishes, and cicatrization commences.

The process is precisely similar to that which follows the operation for fistula *in ano*. The superficial situation and sparing quantity of adeps in the groin, compared with the nates, makes the former a more manageable fistula, i. e. less disposed to sinuses. The divided edges of the gut are in both instances consolidated by a granulating process with the surrounding cellular substance, which retains an indurated and thickened circumference, from the obliteration of its cellular texture by the adhesive inflammation.

If the above conclusions be correct, the practice of dilating the parietal wound so as to expose that of the intestine, for the purpose of stitching them together, is equally unwarranted whether the intestinal wound is confirmed by a fæculent discharge or not.* By diligently watching

* The following extract is a proof that this opinion has not been universally held. "When the intestines are wounded, but not let out of the abdomen, the surgeon can do nothing but keep a tent in the external wound, and

the constitutional symptoms, which will be the same in no two persons, observing the utmost cleanliness in the local treatment, and moderately encouraging the discharge of the matters, we shall not often fail to induce a state favourable to the restoration of the natural function. When the system begins to reassume tranquillity, a judicious regulation of the patient's diet, with the frequent injection of warm and gently stimulating enemas, will cooperate with the contraction of the wound under the healing process in determining the matters towards the anus. I need scarcely say that in substituting the natural for the artificial anus, it is necessary to proceed

after this bleed the patient, advising him to rest, to live abstemiously, and to *lie upon his belly*. But the question may be asked here, whether a surgeon may not very prudently enlarge the wound of the abdomen, that he may be able to discover the injured intestine, and treat it in a proper manner. Truly I can see no objection to this practice, especially if we consider that upon the neglect of it certain death will follow, and that we are encouraged to make trial of it by the success of others. Schacher mentions a surgeon who performed this operation successfully." Heister, surg, vol. ii ch. vii. 3.

that the intestine was then returned, and the integument sewn up. The boy died on the ninth day. In answer to the question by counsel, “ if the wound of the intestine was sewn up,” the surgeons gave it as their opinion, that it did not require a suture. As I have no means of learning the professional details more minutely, I refrain from any comment upon this opinion.

In a preceding part of this Inquiry, two experiments are related which bear directly on this point. The first proves, in conformity with the opinions of Dionis and Heister, that an intestine having a wound large enough to admit the head of a silver blow-pipe, may be safely returned. The second proves, that if a ligature be passed around the wound, the gut may be replaced with equal impunity, and the mode of reparation appears to be precisely the same, whether the ligature is used or not*. I have likewise stated an example of the

* See Experiments E. and Q.

complete success of this practice in the human subject. With these facts before me, I should adopt it without hesitation in all similar cases, observing to cut off the ends of the ligature, as by that precaution it will pass directly by the bowel, and not impede the healing of the external wound.

I shall now suppose the case of a wound or wounds in a prolapsed intestine, of such extent as readily to admit of the escape of the faecal matters. Systematic writers have been pretty uniform in their directions for the management of these cases; and indeed it is probable from this circumstance, as well as from the rarity of their occurrence, that the greater number had no better guide for their judgment, than the judgment of their predecessors. The suture is recommended, and in general that species which we denominate the glover's suture; *one or both ends of the thread being included in the external wound, that the gut may be confined to that point, and the suture readily withdrawn.* Ob-

jections have been taken to the glover's suture by Le Dran, Garangeot, Bertrandi, Desault, Sabatier, and Mr. Benj. Bell : on the other hand, it has received the approbation of Dionis, Wiseman, Heister, Sharp, Gooch, Latta, and others. The objections are trivial and speculative ; and none of the deviations to which they have given birth, appear to me entitled to a preference. I have thrown them into a note, that the reader may form his own opinion *.

* Garangeot condemns the glover's suture, alledging that it is difficult to disengage it without injuring the intestine ; and he substitutes in its stead a suture, the turns of which have a spiral obliquity, without an angle to impede its removal when it is to be drawn away.

Le Dran likewise objects to the glover's suture, and is the author of what has been termed the loop suture—which consists of as many detached threads as the length of the wound may require, passed through the lips of the wound at an interval of nearly a quarter of an inch from each other. The threads being passed and the needles removed, all those on one side of the cut are to be tied together with a knot at their ends, and those on the opposite side must afterwards be secured in the same manner. They are now to be joined and twisted two or three times, so as to form a cord. By this means the divided parts of the intestine are puckered together, so that the stitches, which were before distant, are now brought close to each other. The intestine is then to be replaced, and the threads secured to the bandage ; and after remaining till the wound in the gut is

It is not the kind of suture employed, but the application of it conformably to the principles of its operation illustrated in the pre-

supposed to be healed, they are then to be untwisted; and all the ends of one side being cut close to the external wound, they must now be drawn slowly and separately away. If there is considerable loss of substance, Le Dran advises to confine the gut to the wound by two or three threads, to prevent the escape of matters into the abdomen.

Bertrandi recommends the continued suture passing through and not over the lips of the wound, in which he is followed by Desault and Sabatier. The reason for this preference is an opinion that the edges of the intestinal wound will be prevented from adhering to the integument by the intervention of the thread.

“Even this method of treatment,” says Mr. Bell, speaking of the glover’s suture, “must tend to lessen the diameter of the gut, a difficulty which may be avoided, and the operation be performed with the same degree of security by entering the needle always from the inside of the gut, and pushing it outward. The operation should commence near to one end of the wound; the needle being pushed through one side of the gut, the ligature should be drawn forward, and retained by a knot formed on the end remaining on the inside. The needle must now be carried straight across and entered in a similar manner; but the following and every succeeding stitch will not be opposite to each other. When the operation is rightly performed, the needle will be carried from one side of the wound, in a diagonal line, to the other, and will enter the gut at the distance of two tenths of an inch from the point from which it came on the opposite side. In this manner the sides of the wound may be drawn closely and exactly together without lessening the diameter of the gut in any degree; and the end of the ligature may at last be secured and cut off close to the other extremity of the wound, if the gut is to be put freely into the abdomen; or it may be left of a sufficient length

ceding chapters, which is the object of real importance. The leading objection raised against the glover's suture is the difficulty of withdrawing it without injury to the recent adhesions ; and the attempt at improvement upon it uniformly consists in the removal of this difficulty. It was upon the close connection of the injured gut with the parietes exclusively that the union was supposed to depend ; and it was not hinted before the time of Mr. Benjamin Bell that the suture would be discharged into the gut. He too speaks of it casually, and in somewhat undecided terms. La Faye expressly enjoins that

to hang out at the wound of the teguments, if it is the meaning of the operator to retain the wounded part of the intestine in contact with the external opening. This indeed is usually done that we may have it in our power, as it is said, to draw away the ligature on the wound of the gut being cured. It is probable, however, whatever suture may be employed, if more than one or two stitches have been passed, that it will be difficult, or even impossible, to get the ligature away without hurting the intestines. *I would never advise, therefore, with a view to this, that the ligature should be left out at the wound ; less danger will arise from cutting it entirely away, and allowing the stitches to remain. A considerable part of it will fall into the cavity of the gut.*"—Benj. Bell's Surgery, Ch. 3. Sec. 12.

the two ends of the suture be placed at the extremities of the wound ; for “ by this means,” says he, “ we procure the union of the gut with the peritoneum ; for the wounds of intestines do not heal like the wounds of other parts, but by contracting adhesions with the peritoneum, epiploon, or other intestines*.” Now if this very intelligent writer had been speaking of the spontaneous repair of intestinal wounds, his remark would have been strictly accurate ; but he was mistaken in common with all who have succeeded him, in supposing that an intestine brought together by suture was repaired by the adhesions of the surrounding parts. The process of union in a bowel thus situated, is independent and proper to itself, as is shewn by the experiments which I have related. The slight adhesion of the adjacent surfaces is contingent and not accessory to the

* Sabatier expresses, in stronger terms, precisely the same opinion, in commenting upon Le Dran’s suture, who says that the knitting of the lips of the wound together, prevents their separation, and causes them to adhere.—*Med. Operat.* tom. 1. p. 33.

process. If the surrounding surfaces were essentially necessary to repair the breach, even after the insertion of the suture, it would still afford no argument for the mechanical confinement of the gut; for such a surface is equally presented on all sides, were it possible for the gut to move away from the parietes to the interior. And during the formation of the adventitious peritoneum in which the process of union consists, adhesions will inevitably in a greater or less degree be contracted to the adjacent surfaces. But it is not merely that the practice of a depending extremity of a suture at the wound is unnecessary, but that it is prejudicial, which forms the strong ground of objection to it. It keeps up a connection between the wounds of the bowel and the parietes, which prevents or at least retards the healing of both, and thwarts the intention and provisions of Nature. It is indeed extremely questionable whether a ligature, if drawn through the external wound, had

not better be omitted altogether, since neither the wound in the bowel nor in the tegument can heal until the ligature is withdrawn, whereas if the ligature be cut at the knot, the union is completed before it is discharged, notwithstanding it is discharged sooner.

The ascertained fact of a peritoneal union in all cases, the consequent and natural discharge of the ligature by the bowel, and the demonstrable futility of confining the intestine to the parietal wound, are the grounds upon which I argue the impropriety of the practice hitherto adopted. Wherever the suture is decided upon, it should be complete, the intestine should be returned fairly into the abdomen, and the wound of the parietes be treated as if it had not extended beyond them. Wherever on the other hand, the process of healing is to be left to Nature, no advantage can result from a partial suture or a loop of the mesentery. Both theory and experience give some reason to fear the contrary.

Having explained the operation of the suture, and pointed out the distinction between the union so obtained and the process of spontaneous healing, it only remains that I state to which line of practice the preference is due in cases of intestinal wound. In this question, the difference fairly to be presumed between the cases of wound and hernia, viz. the absence in the first of all inflammatory affection, must not be overlooked. Such a difference occurring in injuries of the external surface, would determine a rational practitioner to very dissimilar methods of proceeding; and I can imagine no reason for departing from commonly approved maxims in the injuries of the intestines.

The grand objections to the practice of returning a wounded bowel without a suture are—the heavy drain upon the system, if as is probable, the evacuation be alimentary;—the irritation occasioned by the continual discharge, and the tardiness of the healing pro-

cess—the danger of future impediment to the free course of the matters from a permanent angularity of the adhering fold, or the encroachment of the parietes upon the tube in healing; and lastly, of future prolapse, and even artificial anus, from the actual deficiency of the paries intestinalis corresponding to the extent of the cicatrix.

The objections now stated do not lie against the suture. The matters, with but slight interruption, such as often occurs from other causes, take their accustomed route; the nourishment of the patient is not withdrawn; the wound is reduced to a simple muscular wound, and may be united, in part at least, by the first intention. The intestine, being truly and directly reduced, recovers position and function; its cylinder is perfect of itself, and not formed by the walls of the abdomen.

If the cases recorded by practical writers be compared, it will be found that these objections to the spontaneous cure are not

exaggerated. The difference in the mode of healing with the suture and without it, makes the one an affair of a few weeks, the latter of months. Mr. Travers's patient (see pages 166 and 167) was cured in six weeks. In M. Larrey's, the ends of the intestine were in opposition, and in a state to contract adhesions, after *two* months, and by diligently following up the practice of Desault, to prevent an artificial anus, the cure was accomplished in *four*.

Unfortunately the limited employment of the suture in intestinal wounds does not allow of an extensive comparison, but of the inconvenience, hazard, and fatality attending the negative practice, we have abundant examples. The more free employment of the suture in hernia has not afforded it a chance for reputation, as I shall hereafter have occasion to shew.

I am not aware that any formal directions are required for the operation of

sewing up a wound of the intestines.* Let a small round sewing needle, armed with a silk thread, be passed near to the lines formed at the bases of the everted lips. The thread is to be carried at short regular distances through the whole extent of the wound, the operator being mindful that an equal portion of the edges is included in each stitch. When the suture is finished, let the thread be securely fastened, and cut close to the knot. The reduction of the prolapsed fold should then be conducted with the nicest caution; and when completed, the wound of the teguments should be treated with a stitch, a plaister, or a poultice, as circumstances dictate.

; The practice embraces two points, 1st. The accurate closure of the intestinal wound, by which the case is reduced to one of simple prolapse. 2d. The careful reduction of the

* The subject of Gastroraphy has occupied a space in most surgical works, greatly overproportioned to its claims. The triangular needles generally recommended for the suture of the intestine are certainly very ill fitted for the occasion;

protruded part, and the union of the divided integuments. The treatment of the two wounds is thus made perfectly distinct; and I contend that this distinction, by which the practice is materially simplified*, is indicated by the facts on evidence, viz. the independent restoration of the cylinder, and the provision made for the ligature in that process. The principle of a preternatural connection between the bowel and the tegument where the union is obtained by the suture, upon which all writers have insisted as essential, is a false one; if it were not, a depending ligature would be nugatory; but whoever will carefully examine the process of restoration will come to the stronger conclusion that it is injurious and in direct violation to the procedure of Nature. The spontaneous healing of an intestinal wound is hazardous and slow, and indicated by no one circumstance of the injury.

* It is impossible to conceive more disadvantageous circumstances than those of a surgeon hampered with an open wound of the intestine while endeavouring to return it.

The union by adhesive inflammation commands the same advantage over that by granulation here as in other parts; as for example, after the amputation of a limb or a tumor.

The artificial anus is sometimes a consequence of penetrating wounds, though it may arise from every species of intestinal lesion. I am strongly disposed to believe that its existence in such circumstances has been more the result of neglect or improper treatment than arising from necessity. It is worthy of remark that the historians of these cases have seldom been acquainted with them in their commencement, at which period they either derived no assistance from surgery, or through accident or ignorance were maltreated. Hildanus sets down as a novel and extraordinary spectacle an artificial anus which he saw in 1604, but which had arisen from a wound with extensive prolapse, two years before. It was occasioned by a fall upon the point of a stake. “ *Intestina quoque per vulnus ad magnitu-*

dinem capitis excidisse, neque ante *tertium* diem Chirurgum habere potuisse, tum intestina reduci non potuisse, nisi novaculâ dilatato prius vulnere; nec tamen reducta intus retineri potuisse, quantumvis summa adhibita fuisset diligentia." The case was an irreducible hernia with artificial anus when Hildanus saw it, and must have presented an appearance similar to a voluminous hernia, of which the integuments have given way *.

In another case, a surgeon having removed a portion of wounded gut equal to a hand's breadth in extent, with the view of sewing together the sound parts of the tube, accidentally let slip the lower portion, which receded into the belly. The upper was then stitched to the wound, and thus was established a permanent artificial anus. †.

Bouchard tells us of a mendicant who begged in the streets of Paris with a station-

* A remarkable example of this state of parts may be seen in an aged female now in Guy's Hospital.

† J. C. Mackius Ephem. Dec. 2. A. 8. Obs. 229.

ary prolapse of the colon, by which he discharged his excrement. It followed a gunshot wound received on shipboard three years before, of which the cicatrix was still visible in the region of the right kidney *. In the case of a soldier of the invalids mentioned by Dionis, it is expressly stated that Nature alone performed the cure, (if cure it might be called) and the industry of the surgeon had no share in it. He was compelled to wear a tin box to receive the matters discharged at the wound †.

Moscatti, surgeon of Milan, gives a case in point. A single penetrating wound with a knife gave issue to a small portion of intestine. The wounded man was conveyed for assistance over a rough road to an hospital at three leagues distance. Upon his arrival, more than three feet of the protruded bowels appeared at the wound. The livid colour of the part deterred the surgeon from attempting the reduction; and he abandoned the case. Pain, heat, tumefac-

* Ephem. Nat. Cur. An. 3. Obs. 8.

† Cours d'Operations, p. 83.

with the most delicate caution. It is common for the more solid part of the food to lodge and be detained in the renovated portion of the canal. There is a tendency to accumulation wherever an extensive wound has been inflicted upon the intestine; first, from the contraction, proportioned to its extent, which has been shewn to take place at the moment of the injury; secondly, from the contraction which accompanies the healing process; thirdly, from the impaired action of that part of the gut which has been the subject of the lesion. The discharge *per anum* should therefore be attentively observed, both as to its consistence and quantity: if it cease, or ceases to correspond with the diminished evacuation at the wound under the continued use of injections, the belly will become tender, and the febrile symptoms be re-excited: under such circumstances, the exhibition of mild laxatives by the mouth may prove advantageous; but should the constipation be

obstinate, and the abdominal pain and tension continue, the wound must without hesitation be dilated, and the bowel be again unloaded.

Of Intestinal Wounds attended by Prolapse.

The third and last class of intestinal wounds, viz. those accompanied by prolapse, fall next to be considered. Of the successful issue of these cases, which are of more rare occurrence than either of the former, we have likewise some well-attested histories. Two methods of treatment have been proposed and adopted with success. The first is the reduction of the gut so as to leave the aperture opposed to that of the integuments, confining the patient in such a way as to prevent a recurrence of the prolapse, and treating it in every respect as the class of wounds last described.

Such is the case of the distiller recorded by Tulpius *, in which the wounded colon

* Tulpii Obs. Med. lib. 3, cap. 20.

lay exposed for more than thirty hours. Being reduced, the fæces passed freely by the wound, which, notwithstanding the notorious irregularity of the patient's life, healed, and he recovered. A hernia formed at the site of the wound, of which he died six years afterwards; and the cicatrix of the intestinal wound was discovered upon inspection of the body. A similar instance is concisely stated by Hollerius*. A man was wounded by a small sword in the belly. The small and a part of the large intestines protruded, and the wound in the bowel discharged its contents. The case was despaired of by the attendants; but by careful treatment the patient recovered.†

An unusually complicated case, illustrating this mode of healing, occurred to Mr. Nourse, surgeon at Oxford. He was called to a young man, who had a prolapse of half the intestinal canal, at a wound

* Obs. ad Cons. Curandi. p. 17.

† See also Harder's *Apiarium*, Obs. 67. 'De intestini tenuis vulnere.'

three inches long, extending obliquely from the left hip to the umbilicus. Mr. Nourse dilated the wound, and with considerable difficulty reduced the gut, making a suture upon the integuments with a depending orifice. The patient was strictly dieted, and his wound poulticed. On the next day he was restless and very low, had a weak, fluttering pulse, cold chills, and an oppressive tightness of the belly. By means of an injection, and an occasional draught composed of manna and almond oil, a copious stool was obtained, lumpy, and mixed with blood. Third day. The fever was not abated, the belly tense and emphysematous, and a deep colored offensive discharge issued from the wound. In the evening he was relieved by two motions with some blood, and breathed and felt lighter. The discharge on the bandage was discovered to be fæcal. Fourth day. He had passed a better night, with some sleep; pulse stronger; skin warm; no appearance of blood in the stools. Fifth. A restless night;

a sunken countenance ; head confused ; frequent but irregular pulse ; thirst ; tightness about the stomach ; free and very offensive discharge. Until now he had been free from nausea ; but in the afternoon of this day, he was seized with a violent bilious vomiting ; and in the effort one of the stitches of the integument broke, so that you might look into the abdomen : he was let blood in the arm. Sixth. The bilious vomiting returned in the night, but was followed by some refreshing sleep ; the pulse fuller and steadier ; the skin about the wound sloughy : the remaining stitches were divided. Seventh. Patient's appearance much improved ; had passed a quiet night ; complained of hunger. The wound was now a horrible chasm, three inches in the least diameter ; and in the bottom of it were plainly seen the circumvolutions of the small guts ; the hollow was filled with dry lint, and the margin dressed with a warm digestive. Eighth day. The fever and all signs of inflammation had ceased,

The wound digested kindly, and was dressed twice daily, owing to the copiousness of the discharge; a little opening medicine was given occasionally, and the nights secured by a few drops of laudanum. In a few days the sloughs of the muscles cast off, so as to shew from whence the fæces made their exit; viz. the middle of the colon, lying between the left kidney and the rectum*.

M. Larrey details the case of an officer who was shot in the belly at the siege of Cairo. The ileon was divided by the ball, and the extremities of the gut drawn apart from each other, tumid and everted, appeared at the wound. The contraction of the upper portion was so considerable as to strangulate the gut, (like the prepuce in

* The tedious and expensive process of healing by granulation is very well described. "After a little time the surface of the intestines looked florid, and began to pullulate, throwing up small grains of flesh from every point. These granules daily increasing united with each other, and after filling up the intervals between the circumvolutions, became an uniform surface, which meeting with that of the raw edges of the integument, they both adhered together, and became one continued sore."

paraphymosis,) and prevent the escape of the matters. The stricture was taken off by small incisions made in the contracted portion; the extremities were then brought together by a loop of the mesentery corresponding therewith, and the parts left within the wound, which was dilated. The first days were tempestuous (*orageuses*); at length the inflammatory symptoms subsided; those depending upon the abstraction of the alimentary matters successively disappeared; and after two months of vigilant treatment, the ends of the intestine were in opposition, and ready to contract adhesions. For two following months the practice of M. Desault was employed in the dressing of the patient, who ultimately quitted the hospital cured *.

Of the second mode of treating these injuries, Mr. Travers, a surgeon of Lisbon, has furnished a notable instance. A portion of the small intestine protruded to the extent of twelve inches through an aperture of the

* *Relation Chirurg. de l'Armée d'Orient*, p. 300.

peritoneum, three quarters of an inch in length, and presented a wound which admitted the finger. Mr. Travers closed the intestinal wound by an uninterrupted suture, reduced the bowel, and sewed the external opening. The alvine discharge was natural; the threads loosened on the twelfth day, and the patient was pronounced well in six weeks*.

Glandorpius mentions two instances of the employment of the suture; one a wound of the ileon, which was plentifully besprinkled with an astringent powder. The patient, as might be expected, died of a gangrene on the fourth day. The second was a wound of the colon in a young man eighteen years of age, by which the fæces were evacuated. It was closed by the glover's suture, and the patient very unexpectedly got well†.

There are doubtless other histories of this description; but these observations satisfac-

* Phil. Trans. Vol. 50. p. 35.

† Spec. Chirurg. Obs. 33 and 34.

torily establish the practicability of either mode of proceeding, and are related with sufficient evidence of accuracy to answer every purpose of citation.

I shall now offer a few practical observations on the treatment of exposed wounds.

The prolapse is a formidable addition to the wound of the intestine; and indeed the hazard attending an extensive prolapse, unless it be treated with judgment and caution, I conceive to be in no degree less than that which accompanies a wound of the intestine *in situ*. While I say this, I am not unmindful of some extraordinary instances of recovery from prolapse, under circumstances of much aggravation*. In wounds attended by prolapse, it commonly happens that the protrusion is immediate and considerable; for if the wound is small, the intestine retains its place.

A recent and interesting example of this injury, very judiciously treated by

* Vide Wiseman, La Motte, J. Bell, and others.

Mr. Hague, of Ripon, will be found in the fifth volume of the Edinburgh Medical and Surgical Journal;* and it will prove that even in skilful hands the life of the patient is in great hazard.

If the prolapsed intestine be reduced in such a manner that each part may recover its natural situation, a vigilant after-treatment will generally subdue the inflammatory symptoms. But if the gut protrudes in quantity, the wound requires to be dilated; and if when dilated, the bowel be returned hastily and in the mass, the patient will rarely if ever escape a fatal inflammation. The scrupulous directions which we have received from systematic writers to return the protruded intestine, inch by inch,

* I had the following singular piece of intelligence in a letter from a professional friend in the country. "I saw lately a hernia about the size of a goose egg, on the right side of the scrotum in a horse. Three months ago, the animal ran a stake into his belly; a large fold of gut protruded, which his owner, a reputable farmer, who himself informed me of the fact, replaced, and then sewed up the muscular wound. The horse is healthy."

in the order of its proximity to the wound, or inversely to the order of its descent, are founded in more soundness of observation than their readers may have generally apprehended. I doubt much, notwithstanding the pointedness of these directions, if in the embarrassment of operations they have been sufficiently attended to. In the operation by the knife, it has appeared to me, from the manner in which I have sometimes seen a voluminous portion of intestine handled, that the object of the surgeon was to introduce it, under whatever complication; and to the gradual and orderly route which the bowel is compelled to take through the undilated abdominal opening. I am disposed chiefly to attribute the generally favorable result of the operation by the taxis, in the strangulated hernia. It is a common remark upon such occasions, that the bowel will replace itself; and so probably it would, if the displacement were not itself the cause of a rapid and extensive inflammation.

A prolapsed intestine may present an inconsiderable wound; such a wound for example, as would not admit of the diversion of the matters from their natural course while the bowel was subjected to the equal pressure of the abdomen. “*Parva vulnuscula sub operatione herniæ non nocere**,” has been affirmed by highly reputed authority; and Heister is decided upon this point: “Small wounds of the intestines, that do not exceed in size the diameter of a goose-quill, should by no means be stitched, but are best left to Nature. If they are left to themselves, they will frequently unite much sooner than if they are irritated by the suture; for stitching usually brings on great pain, inflammation, and other bad symptoms; therefore it will be much better to return them instantly, and to bleed the patient, to prevent inflammation, advising him to rest and abstinence.” So also Dionis, Garangeot, Sharp † and Sabatier ‡:

* Vide Richter, *Biblioth. Chirurg. B. IV. p. 159.*

† *Operat. of Surg. p. 10.*

‡ *Medic. Operat. p. 30.*

“ Lorsqu’elle est trop petite, comme seroit une plaie faite par un poinçon ou par un canif, il n’est pas nécessaire de la coudre, la nature peut la guérir étant secondée d’une diete très exacte*.”

“ Si la plaie est très petite, de quelque maniere que les fibres soient coupées, il n’est point nécessaire d’y faire de suture, & elle peut guérir sans cette opération †.”

Le Dran and Mr. Benjamin Bell incline to a contrary opinion. “ On demande si une playe très petite a besoin qu’on y fasse la suture, &c. Il est certain qu’au défaut du chile les vents le distendent; par conséquent il vaut mieux y faire une suture peut-être inutile, que de manquer de la faire au besoin ‡.”

“ However small,” says Mr. Benj. Bell, “ a wound of the intestines may be, it ought always to be secured with a ligature; for

* Cours d’Operations, p. 76.

† De la Gastraphie. Traité de Chirurg. Tom. 1. p. 186.

‡ Des Playes de Ventre, p. 80.

although it is alleged by some, that we should rather trust to Nature for the cure of a small opening, than to insert a ligature, to me it appears that the opinion is by no means well founded ; insomuch that I would not leave even the smallest opening that could admit either fæces or chyle to pass without stitching it up. Much danger may ensue from omitting it ; and the hazard of the patient cannot be increased by the practice being adopted *."

So widely do the authors last quoted differ in opinion with Paré and Peter Lowe, whose mode of reducing an inflated intestine was by making punctures in it to evacuate the contained air ; and in this state they were accustomed to return it. Blancard* and others protested against this practice on the very sufficient ground of its inefficacy. La Faye very truly says it is a useless as

* System of Surgery, Vol. II. Ch. III. Sec. 12.

* Collect. Med. Physica, Par. ult. Obs. 1.

well as dangerous practice ; for the openings made by a round needle cannot give issue to the contained air *.

The following cases prove that the same reasoning applies equally to small incised wounds.

A man was brought to St. Thomas's hospital, on Saturday, the 30th of June last, who had been stabbed in the direction of

* Sabatier joins in this objection, and opposes the danger of effusion to larger openings. It is surprising that Sharp and Gooch, as well as Garangeot and Van Swieten, should have recommended the practice.

M. M. Chopart and Desault proposed to meet this objection by making large openings, and confining the gut to the integument.

“ Lorsque la quantité d'intestins déplacés est considérable, et qu'ils sont si gonflés & si étendus qu'on ne peut découvrir ni agrandir la plaie, & lorsqu'on a employé inutilement tout ce qui est capable de favoriser la réduction, on en fera sortir l'air en y faisant une piquure, avec une aiguille ronde et *fort grosse*, pour que l'ouverture ne soit point bouchée par les mucosités dont les intestins sont enduits. On préviendra l'épanchement des matières stercorales en passant, avant de réduire l'intestin, une anse de fil dans la portion de mesentère qui répond à la piquure, pour le fixer contre les bords de la plaie extérieure ; et l'on combattra par les remèdes généraux l'inflammation que cette piquure peut attirer †.”

† Traité des Malad. Chirurg. &c. Tom. 2, p. 135.

the epigastric artery, on the left side of the abdomen, by a case knife. He died in eighteen hours, apparently from the sudden and copious hemorrhage which had taken place within the belly. About half a yard of ileon protruded. The gut was highly discoloured, and so much distended, notwithstanding it was pierced in three places, that the wound of the integuments required to be freely dilated before it could be returned. The apertures were in fact obliterated by the mucous coat.

It appeared upon the trial of Captain Sutherland (Ann. Reg. June, 1809) for the murder of his cabin boy, that the intestines had been extensively protruded through a wound near the left groin, and had lain exposed for four or five hours—that the dirk had pierced through one fold of intestine, and entered another—that the wound of the intestine was *half an inch* long—that the reduction could not be accomplished until the parietal wound was dilated, and

tion of the belly, and a high fever menaced the poor patient with a speedy dissolution, when the gut, suddenly bursting, discharged an abundance of fetid matters. This happened on the fifth day from the injury. By degrees the belly softened, the fever abated, the whole of the protruded gut quickly sloughed away ; the strength of the patient rallied, and he recovered with an artificial anus. He wore a tin box, fastened by a girdle about his body, and suffered no further inconvenience. He afterwards asked alms upon the highway, and excited the commiseration of passengers, by a picture representing his disease, with this inscription, “ Qui non vidit, non credet.”

The remarkable case of the soldier wounded at the battle of Ramillies, described with such an interesting minuteness by Albinus*, and in other places by Schacher † and Vater ‡, occurred twenty

* Annot. Acad. Lib. 2. Cap. 8.

† Program. Publicum. Lipsiæ.

‡ Phil. Trans. 1720.

years before he saw it. It was a transverse wound below the left ribs, which was a little dilated, and then bound up by the surgeon. On the following day, the aliment which had been taken previous to the injury, appeared in the wound. It was now dilated at each extremity, until it exceeded a span in length.* Upon this the contained air and excrement immediately burst forth in quantities. The man was prohibited solid food, and for two days was sustained upon broths. These passed off so rapidly, that for ten whole days he suffered from keen hunger; when a fellow soldier, pitying his condition, privately supplied him with bread and meat, which he greedily devoured, and was able to retain for several hours. The wound in the mean time was narrowing by cicatrization; but as the matters which escaped were of more consistence, a portion of the intestine began to protrude; and when he left

* “Tunc et à priore, et à posteriore parte incidendo auxisse, sic ut spithamam longitudine excederet.”

his bed, two protrusions appeared, one at each extremity of the aperture, which in the course of time increased to the original dimensions of the wound. The two portions, when fully prolapsed, represented one gut, inverted, and attached at its middle and most capacious part to the wound. When the upper portion was reduced, the opening into the colon appeared, through which it was accustomed to prolapse. If the circumstances of the treatment adopted in this case be impartially considered, I think it will be granted, that no method could have been devised to bring about the actual event with a greater probability of success.

That this most formidable consequence of such a lesion of the intestine as we are now considering, is a consequence of improper treatment, these and other cases render in the highest degree probable ; for there is no loss of substance incurred, as in the case of an abscess or a gangrenous hernia, which are more frequent causes of

the calamity. It must be evident, however, in all those cases in which the wound of the intestine is not repaired *per se*, that the case is in fact equivalent to a loss of substance, as the repair of the gut is common with that of the parietes, and the parts will stand or yield together. It is the angular disposition, more or less acute, of the extremities of a gut which has suffered a breach of substance, that gives rise to the formation of an artificial anus. And wherever the healing of an extensive wound in the bowel is effected by its coalescence with the parietal, this angular disposition, greater or less, is inevitable. The danger of artificial anus is therefore in proportion to the extent of the wound, and the consequent dependance of the intestinal wound upon the parietes.

In the complicated wound unattended by prolapse, there is no reason to apprehend this result, unless the surgeon, from mistaken notions, should dilate it without occasion, or beyond what the occasion requires; and in the

wound attended by prolapse, sewn up and reduced without any artificial connection, it is just as little to be dreaded. Neither do I believe a record exists of artificial anus following the successful application of a suture to a wound of the intestine, or is ever likely to happen: but where the healing is abandoned wholly to Nature, or the wounds of the gut and the integument are by a mechanical contrivance identified with each other, it will require some management to prevent the occurrence of an artificial anus.

There are two valuable papers on the subject of the artificial anus, well known, probably, to most of my readers. I refer to those of M. Sabatier, in the fifth volume of the *Memoirs of the French Academy*, and of M. Bichat, in the second volume of the works of Desault. In these dissertations the various circumstances which give origin to the disease, its history and treatment are discussed. M. Sabatier was reduced to the conclusion, that the disease admitted only of

a palliative treatment ; but Desault, with an enterprise and perseverance characteristic of his genius, solved the problem of cure in a case of the most unfavourable kind, after four years of duration. The details of this most valuable discovery are highly interesting ; but as it is not the cure of the disease which I am now occupied in considering, I forbear to enter upon them in this place. The following extract however, is important to my purpose, inasmuch as it confirms the opinion above stated respecting the origin of the artificial anus.

“ Whatever be the species of lesion which the bowel has undergone, it offers as an invariable phenomenon the adhesion of its divided parts to the circumference of the parietal opening ; which salutary adhesion, arising from the inflammation preceding gangrene and consequent upon wounds, prevents the effusion of the matters into the abdominal cavity, and thus essentially constitutes the artificial anus. The walls of the abdo-

men, if perfect, form a supplement to the deficient portion of the canal; and the matters will continue to pass as usual, by the rectum, if the divided portions of the intestine adhering to the parietes *do not form an angle so acute* as to arrest their progress. This angle, formed by the two portions of the gut at the point of division, is not a rare disposition, as Morand remarks. It opposes a resistance to the matter proportioned to its acuteness, so that if it approaches to parallelism, all access to the inferior portion of the canal will be prevented, while the matters will escape in part this way, if it approaches to the perpendicular. Now when a large portion of the canal has been destroyed, or when the tube has been cut across, it assumes the former disposition. The second is for the most part observed when the section has included only a part of its paries. We conceive that the difficulty of the cure is in the direct ratio of the one and the inverse of the

other, and that the projection of this internal barrier is always more or less an obstacle *."

It must be evident that the angular disposition of the extremities of a divided gut, here alluded to, can never result from the artificial union by which the tube recovers its original integrity, but must always accompany, in a greater or less degree, the spontaneous or natural process of healing. The propensity to so loathsome a disease, is to be numbered among the inconveniences of consigning the cure to Nature, and the prevention of it is an irresistible argument for the employment of the suture, wherever the wound is of such extent as to interrupt the continuity of the canal. By investigating the causes of disease we may often arrive at a knowledge of the means of prevention, as well as of cure.

* Œuvres de Desault, par Bichat, tom. 2, p. 354.

CHAPTER VI.

STRANGULATION OF THE INTESTINE, PRIMARY AND SECONDARY—ORIGIN OF THE SYMPTOMS, AND CAUSE OF THE PERITONEAL INFLAMMATION WHICH PROVES FATAL IN HERNIA—FREQUENT FAILURE OF THE OPERATION PRIOR TO THE ACCESSION OF GANGRENE, EXPLAINED.

IT is not without a feeling of diffidence that I enter upon a subject which has been handled by so many able and experienced men. The points of enquiry however, to which I propose to direct the attention of my reader, viz. the circumstances and treatment of the intestine in a state of strangulation, have not, as I think, received an adequate share of professional consideration.

If it be true that a considerable proportion of the operations for strangulated hernia, even prior to the accession of gangrene, proves unavailing, the frequency and fatality of the disease, during the active and useful periods of life, and among the active and useful classes of society, entitle the subject to a more strict investigation.

The immediate cause of strangulation has given occasion to some discussion among writers on Hernia. It has been generally referred to the narrowness of the aperture through which the gut has been protruded by an extraordinary effort, or to the reaction of the distended bowel upon the aperture by which it escaped. Some writers of reputation consider one species of hernial stricture to be spasmodic.* All circumstances concur to denote the operation of one or both of the former causes; the latter does not admit of satisfactory evidence. I would term that strangulation *primary*

* Vide Richter. *Traité des Hernies* par Rougemont, Chap. XI. & XII. and Schmucker, *Obs. Chirurg.* Tom. II.

which takes place upon the protrusion of the bowel by an extraordinary effort, and that *secondary*, in which the gut already prolapsed, whether reducible or adherent, is confined from distension of its tube, or congestion of blood in its vessels.*

The distinct operation of these causes is faintly indicated in Nature. It is evident upon reflection, that they must always ultimately co-operate in a greater or less degree. But there are differences in the history and appearances, the progress of symptoms, and influence of remedies, which serve, at least in many cases, to distinguish the primary from the secondary species. The former for example, is traceable to a casualty or occasional cause, and happens to persons capable of strong bodily exertion: the tumor is small and tense, and often quickly affects the color of the skin; the pain is local and acute, and all the symptoms

* Of this species is the 'Hernie par engouement' of the French.

are sudden in their accession, and rapid in their progress. The latter, on the contrary, arises from neglect, and generally gives warning of its attack. The patient is predisposed to the disease, or has had a rupture; the swelling is more voluminous, the skin less tense and unchanged in appearance, the pain nauseating, and diffused over the belly, all the symptoms more gradual, and oftener relieved by the Taxis. Such is an outline of the difference in extreme cases, for which it is not difficult to account. The primary strangulation is formed at once. The naked gut exposed to it dies from congestion; the stricture is in fact equivalent to a solution of continuity between the parts above and below it. In the secondary strangulation, costiveness and cholicky pains, with flatulent eructation, usher in the more urgent symptoms. The stricture is induced gradually, and excites inflammation of the contents of the sac, since the obstruction is not so complete as to cut off the vascular communication. In this case

gangrene sooner or later succeeds, and terminates inflammation.

It is the prevailing opinion of our best writers on hernia, that ruptures inflame indiscriminately, that the inflammation spreads upwards into the abdomen, and that thus the disease proves fatal. It is likewise the opinion of the French surgeons, who consider the inflammation in many cases, as suppurative, and spreading along the mesentery.* As I have been led to view the local injury and its effects upon the system in a somewhat different light, and it is of the last im-

* These gentlemen have formed peculiar notions on this subject. They consider the species and extent of the inflammation to be determined by the part strictured. The reasoning employed to account for this phenomenon is as hypothetical as its existence, wherefore I shall content myself with giving the statement. If a part of the cylinder be strictured, or even the whole diameter, provided the stricture but includes it and no more, adhesion to the ring has taken place, and the inflammation and gangrene of the part are purely local; but when the strangulation includes a loop of the intestine, it is loose and unadhering; and inflammation and gangrene extend equally on both sides of the stricture. Vid. Louis, Chopart, Desault, Sabatier, &c.

portance that we should obtain a correct idea of the changes which actually take place, and of the relation which the symptoms bear to these changes, I shall dwell a little upon this topic.

I have stated at page 153 of this inquiry, that the abdomen has never presented an appearance of inflammation, after the infliction of wounds by which the intestines were freely evacuated. I have repeatedly formed herniæ in animals, imitating the secondary species of strangulation by drawing a loop of intestine through a small muscular orifice, and the primary, by making a tight ligature upon the protruded gut. The former produces inflammation of the stric-tured bowel, and if the obstruction is complete, the animal dies of general peritoneal inflammation. The latter rapidly induces sphacelus, in which state the gut bursts, and speedily gives issue to the contents of the upper bowels. The animal is immediately relieved by the dis-

charge; an artificial anus is formed; and though the experiment is ultimately fatal, the peritoneal surface invariably remains healthy. In both cases a firm circle of adhesion is formed at the peritoneal opening. To discriminate between the effects of the obstruction, and of the local injury, I combined these experiments in a third; the result of which appears to me decisive of the position, that the obstruction, and not the local injury, is the cause of the peritoneal inflammation.

EXPERIMENT T.

A loop of intestine, four inches long, was drawn through a small incision of the parietes; the anterior half was strangulated by a tight ligature on the outside of the integument, which was then sewed close around it; and the remaining two inches were left to inflame in the space between the muscles and the skin. The slough of the

strangulated part speedily followed, and suffered the matters to pass externally. The animal lived a week, and then sunk under the drain from the wound.

Examination.—The intercepted portions of bowel were highly inflamed, and their contiguous surfaces adhered; the sloughs were detached by ulceration in the line of the ligature, but all within the abdomen appeared healthy.

This experiment proves that inflammation of the strictured gut, when existing in the greatest degree, does not spread into the abdomen or extend above the stricture, so as to affect the peritoneal surface.

If we reflect upon the consequences of a total obstruction to the passage of the matters, by whatever cause induced, we shall discover in it the real cause of the peritoneal inflammation which proves fatal in hernia. The local injury would scarcely affect the system if it were not for the derangement of the intestinal function. It

will be found that the symptoms are in all cases proportioned in severity to the degree of obstruction. If such a portion only of the cylinder of an intestine be strictured, as does not interrupt its action, and thus render it a cause of obstruction, it is not followed by the symptoms of strangulation: and on the other hand, if the action of the gut is suspended by a partial strangulation, it proves fatal equally with a strangulation of the entire cylinder.* But if the inflammation of the part included in the stricture tended to spread upwards into the abdomen, a partial strangulation should be followed by inflammatory symptoms.

It may be said, that the stricture of the omentum sometimes produces the symptoms of strangulated hernia. In such cases it will be found, that the volume or the connections of the protruded part obstruct the

* See the cases of partial strangulation, in the succeeding chapter.



function of the intestines. The symptoms supposed to characterise strangulation are never co-existent with a natural state of the alimentary canal, but they have been often witnessed in the absence of a strangulated hernia. Yet the symptoms of strangulation have been thought so peculiar as to admit of ready distinction, setting out of view the external signs. It must have happened to others, as to myself, to make sure from the symptoms of a patient that he had a hernia, and upon examination to find none; a sufficient proof that such a distinction is hypothetical. The characteristic symptoms of strangulated hernia, are to be found in all cases of permanent intestinal obstruction, from whatever cause; in proof of which position, I shall mention a remarkable case which I visited with Dr. Babington, but a few hours before its termination.

CASE.

A robust man, 40 years of age, had been long subject to occasional constipation attended with cholic pains and nausea, from which he usually obtained relief by taking a draught of tincture of rhubarb. At two in the morning of Monday 8th January, 1810, he was seized with acute pain in the hypogastrium, which was followed by sickness and vomiting. At seven o'clock his apothecary saw him. He had then vomited three times: the belly was not tense, nor was his pain increased by the pressure of the hand; but his pulse was quick and small. He was bled freely, and took a pill of cathartic extract and calomel, and an infusion of senna and purging salts; these medicines were ordered to be repeated every two hours, if required. About noon the vomiting recurred more frequently, and was uniformly followed by a short interval of

ease *. The medicines having twice been rejected, a purgative glyster was administered, which returned unaltered. The countenance of the patient now became extremely anxious: his pulse above an hundred, and small—thirst extreme—breathing interrupted by sighs, and frequent eructations—no passage of flatus by the bowels, and a painful sensation of tenesmus.

In the evening, all the symptoms were aggravated: the pulse not much quicker, but the pain more severe. He had hiccough, and cramps in the calves of his legs, and was very apprehensive of his situation. At night the belly swelled, the pain reached round to his shoulders, back, and loins, so as to require continual friction; the vomiting was plainly *fæcal*, and almost incessant: towards morning he was greatly agitated, and with difficulty kept in bed. At half past seven o'clock he expired, having lived about twenty eight hours from the commencement of the attack.

* I have noticed this coincidence upon similar occasions. The inversion of the stomach which constitutes vomiting, and in part perhaps the evacuation takes off for a time the nismus of the bowel above the stricture.

Inspection at Two o'clock P. M.

Abdomen tympanitic—the surface of the small guts streaked with red lines, presenting here and there broad livid spots adjoining the mesentery—some old adhesions of the bowels laterally and to the mesentery—the alimentary tube distended to the utmost with fluid till within about eighteen inches of the valve of the ileon, from which point it was suddenly contracted, and perfectly empty as far as to the termination of the colon. The contracted portion of the small bowel would not have admitted the little finger without extension. The villous coat of the stomach was unusually vascular and some extravasation appeared beneath it; that of the bowel was healthy.

There could be no doubt that the inflammation in this case was set up by the obstruction, which appeared to have been caused by a spasmodic contraction of the ileon. The constitutional symptoms so accurately corres-

ponded to those accompanying strangulation, that I expected to have found a mesenteric or other concealed hernia.

Still more satisfactorily to prove that inflammation of the peritoneum is directly excited by obstruction in the canal, without the slightest mechanical injury of the peritoneal tunic, I subjoin two cases of strictures of the colon, the subjects of which were attended, and examined after death, by my much valued friend and colleague, Dr. Farre.

CASE.

Mr. J. A. ætat. 63, led an inactive life, ate heartily, drank temperately. The functions of his alimentary canal had been disordered for many months, indicated by extreme flatulence, especially after eating, and occasional vomiting. On the first of March 1805, I observed the following symptoms of inflamed intestine and peritoneum : obstinate

constipation, frequent vomiting of a dark, but not offensive fluid, distended abdomen, occasional severe griping pains, frequent hiccough, excessive flatulence, furred and parched tongue, pulse 84. The ordinary mode of treatment served to palliate, but failed to arrest the progress of the inflammation, which proved fatal on the fifteenth day.

Dissection eighteen hours after death.

Abdomen very tumid, chiefly from distension of the intestines: a part of the jejunum, the whole of the ileon, and the right extremity of the colon were acutely inflamed, their peritoneal coat being very red, and covered with soft lymph. The cæcum was enormously distended and gangrened. It burst on being handled, and a quart or more of a brownish fluid, loaded with gas, escaped. About a finger's length below the cæcum, there was a

stricture of the colon, produced by a contraction of its peritoneal coat, and an induration of its mucous coat; forming a kind of cartilaginous ring, that almost closed its canal. Above the ring was found a plumb stone, which probably formed a moveable valve upon the aperture, and rendered the obstruction complete. This ring was the boundary of the inflammation. The rest of the colon and the rectum were not at all inflamed, and were quite empty. In the contrary direction the inflammation diminished in proportion to the distance from the stricture, and the upper part of the jejunum, the duodenum and stomach were free from it. The peritoneum of the parietes, opposite to the cæcum and strictured colon, was much inflamed, and its cavity contained a sanious fluid.

The case which follows is valuable, as contrasted with the former. The same disease existed, but the obstruction being

relieved by a process of nature, the peritoneum remained healthy. For this I am likewise indebted to the same active and intelligent observer.

CASE.

Mr. B. æt. 50—60. corpulent, for many years affected with uneasy sensations in the left iliac region. Finally, a tumor formed externally between the umbilicus and anterior superior spinous process of the ilium, on the same side. From a puncture into the tumor, a dark fætid matter with much gas was discharged.

I saw this gentleman in 1804, a week before his death. The induration of the integuments and cellular membrane, extended from the ileon, almost to the umbilicus. In the center of this tumor from a small aperture which communicated with many sinuses, a dark frothy matter was discharged, which immediately blackened a silver probe. Many months

had elapsed since the tumor had been opened, and he was now sinking fast. His appetite had long since failed, his pulse was very languid, and he had frequent hiccough.

Dissection a few hours after death.

The cellular membrane in the seat of the tumor, was very hollow and discolored. To the peritoneum which lined this portion of the abdominal parietes, the colon just above its sigmoid flexure, and a portion of the small intestine adhered. There was a stricture of the colon at this part for more than six inches, caused by an excessive thickening of its tunics. The morbid intestine was surrounded by a large mass of diseased cellular membrane, loaded with discoloured adipose substance. A probe, very much curved and introduced into the aperture of the integuments, passed by a circuitous rout into the colon, the contents of which were pre-

cisely the same as the matter which was discharged externally. The small intestine had also a slight communication with the colon. The rest of the alimentary canal and abdominal viscera were perfectly healthy, except that the kidneys contained a quantity of sabulous matter.

The results of experiment and of disease now related lead me to the following conclusions :

That stricture, in itself considered, is not an exciting cause of peritoneal inflammation:

That it is an injury dangerous to life, only from the continued interruption which it offers to the functions of the canal : and

That the intestinal obstruction is the cause of peritoneal inflammation in strangulated hernia.

These conclusions are consistent with the general and speedy relief obtained by the manual reduction of the gut in an early stage, and the relief obtained in all stages by an evacuation of the canal, which evinces the

recovery of the peristaltic action. It explains likewise the continuance of the symptoms after the return of a gut which has been paralysed by stricture, and is incapable of taking up its natural action. And it further explains why inflammation may be actively and successfully contended with when an evacuation is obtained, and why until this point is gained, all our efforts are fruitless.

The consequence of referring the whole morbid train to the local injury, has been to excite surprise among practitioners that the urgent symptoms of the disease should continue, after the replacement of the gut unaffected by gangrene. But a part may for a certain time retain its texture under the suspension of circulation, sensation, and temperature. If the view which I have taken of the origin of peritoneal inflammation in hernia be correct, it follows that the imperative indication is, by some means or other

to procure the evacuation of the upper bowels. To this object the natural action of the muscular fibres of the intestines is essential. Now if a bowel which has been strangulated, has lost its propelling power, how is the intention of the operation accomplished by its reduction? The liberation and replacement of such a part is by no means equivalent to the restoration of the natural action. It must be clear that a delicate organ subjected to severe constriction for days together, is not at once restored to health by being released. The indication therefore is not fulfilled by the liberation of the gut, unless it speedily resumes its peristaltic action; for if its recovery, however ultimately certain, is a gradual process, the symptoms go unrelieved, and under these circumstances, dissolution is a rapid one.

I believe it is generally said of those cases in which the symptoms do not yield to the operation, that the inflamma-

tion had advanced too far to allow of its arrestation, and that it has consequently passed into gangrene. This opinion however is unfounded. An intestine, discolored in the highest degree, upon which the lines of stricture are indelibly marked, retains the precise appearance, when replaced in the abdomen, which it exhibited in the sac. This fact comes strongly to the support of the opinion which I have advanced, and is confirmed by some of the cases which follow.

CASE I.

Mary Kelly, was admitted into Guy's Hospital on the 20th of January, 1810, with strangulated femoral hernia. Ice was applied to the part. Tobacco leaves, warm bath, and repeated attempts to reduce the rupture under the influence of these means, failed. 21st. The operation was done at 12 o'clock; a pretty close adhesion of

the strangulated parts to the sac, rendered reduction somewhat tedious ; it was nevertheless completed. At 8 p. m. the patient was tolerably easy, the stomach having been somewhat more tranquil ; no evacuation ; an injection was administered.

22d. The glyster was followed by an inconsiderable evacuation ; she passed a sleepless night ; tension of the belly ; pulse 112 ; hot and dry skin ; great thirst ; furred tongue. In the evening the abdominal tension increased, patient very restless, continually turning, but not complaining of pain ; stupor—feeble pulse—cold extremities, and death at 12, p. m.

Permission could not be obtained to open the body.

CASE II.

Mrs. S— an elderly woman, but of strong constitution, had long worn a truss for an inguinal rupture, and was habitually costive.

Being seized one night in November last with cramp in her stomach, she loosened her truss, which owing to some late alarms from the descent of the gut, she wore at night. At ten in the morning, she found the rupture down, and great pain coming on. Her apothecary, an experienced practitioner, failed in his attempts to reduce it. The pain increasing and the stomach being excited to vomiting, I was desired to visit her, which I did at ten at night. As I succeeded no better in my efforts to return the rupture, which was tense and elastic, and of the size of a large fist, I proceeded to the operation.

About eight inches of small intestine, discoloured, but of sound texture, with a copious collection of sanious serum, formed the contents of the sac. A firm stricture existed at each extremity of the inguinal canal, which being successively dilated, the folds, in part evacuated by pressure were returned without force, and in good

order. She expressed no relief from the operation, which she bore with much resolution. I directed fomentations to be applied over the belly, and a warm gruel glyster to be injected. Next morning I was surprised to find her wholly unrelieved: the constipation, tension, pain, and vomiting continued. A solution of Epsom salts had been rejected by the stomach, and flatus only had passed *per anum*. The symptoms continued, and she died at one o'clock the following morning: twenty-six hours from the operation.

I was not permitted to inspect the body.

CASE III.

Thomas Montague, a muscular man, æt. 25, was brought to Guy's Hospital, in May, 1810, with a rupture in the left groin, which had been strangulated twelve hours. It could not be reduced, and the operation was performed. The sac contained

a portion of omentum, which had resided in it for two years, and a knuckle of small intestine tightly girt and highly discoloured. The omentum was retrenched, and the bleeding vessels secured by silk ligatures, which were retained in the wound. The patient was carried back to his bed, but experienced little if any relief. Constipation, pain, bilious vomiting and eructations continued; his pulse was quick, and very feeble; medicine was rejected, and injections returned without fæculent discharge. In a few hours he fell into a stupor, being with difficulty urged to speak; his pulse became imperceptible: he had a death stool, and expired.

Inspection on the following day.

Abdomen very tumid—wound in a suppurating state—omentum drawn in a broad sheet from the transverse colon to the wound, where it was braced by old ad-

hesions to the mouth of the hernial sac. The small bowels, greatly distended with air and fluid matters, adhered slightly by their contiguous surfaces. The gut which had been strangulated was conspicuous from its dark color; it was about four inches long, and exactly defined by two annular contractions and filled with fluid; it had undergone no discernible change since its return; when the finger was passed into it, the contractions presented the sensation of membranous valves. Below the stricture, the ileon turned small and was collapsed, empty and pale to its termination. The cæcum and caput coli held solid fæces. The remainder of the large bowel was contracted and empty.

CASE IV.

A stout young man had a congenital rupture, which became strangulated after a severe fit of coughing. He was brought to St. Thomas's hospital, on the 3d of

November, 1810. After twenty-four hours had elapsed, during which a full trial was given to the preventive means, the operation was performed. A large portion of irreducible omentum was removed by the knife. The intestine, though much discolored, was sound, and after the dilatation of the stricture, replaced. The patient experienced little relief. On the following morning an evacuation was obtained by glysters, but griping pain, tension, and vomiting continued; pulse 110, skin feverish, tongue furred, urgent thirst. Early on the morning of the second day, he died.

Inspection same day.

Small intestines distended with air and fluid matters, and inflamed: omentum confined as in the last case to the mouth of the sac. The strictured portion, defined by the cylindrical contractions, partook of the general fullness of small bowels, but was not altered to appearance from the state in which it was returned. The large bowels were collapsed.

CASE V.

A femoral hernia in a middle aged man, had been strangulated for forty hours. Although the intestine had not given way, the operator expressed his doubts of its recovery; but seeing no alternative, it was returned. The symptoms went on, and the patient died on the third day. Upon inspection, the ordinary appearances of inflammation were presented; the strangulated part remained precisely in the same state as at the time of the operation.

I shall not detail more cases of this description, because those who see the practice of large hospitals must know that they are by no means rare.* My object in

* I may observe that this is just that description of cases which, notwithstanding its frequency, has nearly escaped record, and where it has been recorded, the result has been otherwise interpreted. Desault referred it to the prejudicial effect of the taxis*; others to the supervention of gangrene.

* See a case in point. *Œuvres Chirurg.* Tom. II. p. 334. The hernia had been strangulated only fifteen hours before the operation; the intestine was discoloured, (contused) not mortified; the symptoms continued, and the patient died on the third day.

relating them has been to shew, first, that there is a state of the intestine wanting the criteria of gangrene, in which the operation does not arrest the symptoms caused by obstruction. Secondly, that such intestine when examined after death remaining unaltered, no signs of disorganization being present, there is much reason to suppose that it has been palsied by the duration and severity of the stricture*. Thirdly, that the return of a bowel unequal to the resumption of its muscular or peristaltic action, counteracts the intention and defeats the success of the operation, for though the strangulation is removed, the only dangerous consequence of it, the obstruction, continues.

* If we consider the paralysing effect of acute inflammation attacking a muscle; the inability of the œsophagus, the urinary bladder and other parts to obey their natural stimuli when so affected; we shall have no difficulty in accounting for the torpor of a bowel recently released from strangulation. Not only is the tissue of the organ gorged with a preternatural quantity of blood, but of blood unfitted by its stagnation for the maintenance of the vital functions. Vide Bichat. *Anat. Gener.* ‘*Système Musculaire de la vie animale.*’ Tom. III. p. 276.

I am aware that a different explanation of such cases as those now related, might be offered with sufficient plausibility. That for instance, inflammation had seized the peritoneum before the operation was resorted to. Such an opinion is by no means inconsistent with my ideas of the origin of the peritoneal inflammation, nor is it inconsistent with the numerous instances of a fortunate termination, in which the local inflammation had gone farther. For it is worthy of remark, that in all these cases the obstruction has been removed by the progress of the local disease, and if the vital powers were not exhausted by the wear and tear of the system in a state of such excessive and universal commotion, from the moment in which the obstruction was removed, the system has rallied. Let it be admitted then, that peritoneal inflammation exists at the period of the operation: is the patient in a state to bear copious and repeated evacuations of

blood, after the return of the gut? will it be right to take up the active treatment of the case as one of simple inflammation? I have known the lancet very freely used after the operation, and well marked symptoms of peritonitis give way to its employment. The same treatment has sometimes been required after a late reduction by the taxis, but be it observed, that in all such cases, proper alvine evacuations have been previously procured.* The annexed case will best illustrate this statement.

CASE.

Thomas Winterson, ætat. 28, Gardener, was admitted into Guy's Hospital, on Wednesday, the 29th of May, at eleven o'clock, a. m. with a strangulated inguinal hernia on the left side, which first made its appearance two years ago; he could completely return its contents prior to the strangulation, which took place on Tuesday 28th, at 5 o'clock, p. m.

* See an excellent case by M. Pelletin. *Clinique Chirurgicale*. Tom. III. p. 45, Paris, 1810.

The first symptom was a pain in the tumor after attempting to lift a heavy weight on his shoulders. He went home to bed, but could not reduce the rupture; the pain continued to increase rapidly; the abdomen became swoln, tense, and tender upon pressure; he was sick, vomited, and continued so to do, until the time of his admission; he also had hiccough before he left his home, which was four miles distant.

His surgeon had applied cold to the tumor, had given him a tobacco enema, and bled him freely.

At the time of his admission the left side of the scrotum was swoln to nearly the size of a pint pot; very much inflamed, painful, and tense.

The operation was performed without delay. When the sac was opened, about two drachms of a coloured fluid escaped, and the omentum first came into view; when this was raised, a large portion of

inflamed intestine appeared, and upon its surface were seen four spots of a livid color. The omentum was of natural appearance; but as it adhered to the mouth of the sac, and could not be returned, even when the stricture was divided, it was removed, and six of its vessels were tied; when this had been done, the intestine was returned. The wound was dressed with lint and adhesive plaster, its sides being connected by sutures. Eight hours after, an aperient enema was given, from which the patient had a stool. At eleven, p. m. his pulse being hard and full, and his skin and tongue feverish, eight ounces of blood were taken from the arm, another enema was given, and half an hour afterwards, two table spoonfulls of castor oil.

May 30th. At two, a. m. he had a copious stool, another at half past three, and a third at five, a. m. At seven he was much better, and free from pain in the

belly; pulse only 74; took a dose of a mixture containing sulphate of magnesia; at eleven, p. m. it had operated; at two, p. m. the medicine was repeated, and again twice during the day. In the evening, pulse being 98, full and hard, he was bled to twelve ounces; and at five p. m. he had another motion. His pulse was reduced, but he complained of much pain in the belly, and a few drops of the tincture of opium were given him, in a dose of the saline mixture.

May 31st, passed a tolerable night; pulse, 90, and soft; having risen however, eight ounces of blood were drawn from the arm, and half an ounce of castor oil was given him, which operated.

June 1st, a bad night; pulse, 95; six ounces of blood taken from the arm. Having had no stool, castor oil was given, which answered the purpose. Nine p. m. The pulse having risen considerably, and patient complaining still of

pain in the abdomen, eight ounces of blood which was sisy, were taken from the arm. He had three stools during the ensuing night, and was restless.

June 2d. Pulse being full during the day, ten ounces of blood were again taken from the arm; it was buffy and cupped: mixture continued. In the evening, he had retention of urine; his water was drawn off, and he passed a good night.

June 3d. Took castor oil, which operated four times. Pulse 90, but rather feeble; well through the day.

June 4th. A restless night; pulse 84; had no stool since yesterday; the oil was repeated, and operated.

June 5th. Doing well.

June 6th. No stool since yesterday morning; oil ordered; in other respects well. Shortly after, the man left the hospital cured.

This instructive case strikingly points

out the rapid rally of the system, after evacuations have been obtained, from that state of prostrate and death-like debility induced by the symptoms of obstruction.

The restitution of a function so important, and of such universal influence, gives a new character to the inflammatory action. It is backed by all the natural power of the system, well nigh extinguished by the continuance of that irritable state of the digestive organs, which an observation of its effects has taught us to produce artificially in the practice of medicine, for the purpose of checking the overwhelming violence of arterial action. If then the passage of the matters be restored, pain in the abdomen, heat of skin, quick and hard pulse, invite, rather than deter us from the use of active antiphlogistic remedies; but failing in this grand object, it would be preposterous to expect that the powers of life could support them. Indeed the condition of a patient

labouring under the symptoms of a confirmed intestinal obstruction is such as no man can mistake. How remarkably opposed to that which ensues upon its removal and the restoration of the natural functions : tranquillity is substituted for tumult, and slumbers take the place of suffering and anxiety.

I know of no disease in which the powers of life are so soon enfeebled, as that of a continued and complete obstruction. The agitation into which the whole system is thrown by the unremitted excitement of the stomach and bowels to a series of morbid actions, depressed as it is by a total privation of nourishment, is sometimes such as to exhaust the vital powers, before one symptom has presented itself to discourage the performance of the operation.

I well remember to have seen a man, whose hernia had been strangulated six and thirty hours, with perfect collection of mind assent to the operation. Being

placed on the operation table, the groin shaved, and the surgeon just on the point of commencing his incision, the man's knees fell suddenly, and he expired. The tobacco enema had not been administered. The gut though much discolored, was altogether free from gangrene, nor could any other morbid appearance be discovered. This case happened at St. Thomas's Hospital, in December, 1804.

It will not be inferred from the tenor of my observations in this chapter, that I intend them to apply indiscriminately to every strangulated enterocele. It cannot be thought that I take objection to the practice generally adopted, when the state of the patient and of the part holds out a reasonable prospect of the reaction of the latter, within the period allotted by nature. I have simply endeavoured to impress the important facts, that the danger in strangulated hernia consists originally in the obstruction, and consequent derangement of the intestinal function: that

there are cases in which the operation is attended by no mitigation of the disease : that there is a state of the bowel, short of gangrene, in which it is unable to take up its natural office, and in which its reduction merely, avails nothing ; that obstruction continuing, death is inevitable ; and that where a passage for the aliment is obtained, whether artificially or otherwise, the existing inflammation may often be opposed with success.

CHAP. VII.

REDUCTION BY THE TAXIS—BY THE KNIFE
 —AFTER TREATMENT—PHENOMENA OF
 PARTIAL STRANGULATION — VARIOUS
 METHODS OF TREATING MORTIFIED IN-
 TESTINE—OPINIONS OF PRACTICAL WRI-
 TERS.

IN the preceding chapter I have freely stated those opinions, which an attentive consideration of the phenomena of strangulated hernia had suggested to my mind. Although I should seem to have enforced them with earnestness, I am not so tenacious of the doctrine, as to suppose that it is without exceptions; or so sanguine in my expectation of the advantage to be derived from it, as to conclude that it will render the disease uniformly more tractable. Other circumstances besides obstruction, may for aught I know, induce the same symptoms, as other circum-

stances do unquestionably excite peritoneal inflammation; and though the symptoms of obstruction in most cases subside after a complete evacuation, yet whoever has seen much of strangulated hernia, must know that there are cases in which a destructive inflammation has taken possession of the abdomen at a period so early, that evacuations afford no relief. The hints which I have thrown out admit of general application in a greater or less degree, but like all doctrines of general application, will be modified by the circumstances of individual cases.

Before dismissing the subject, I shall offer a remark or two on the treatment of strangulated hernia in the inflammatory stage. The rapidity with which the symptoms advance to their termination in some cases of primary strangulation, in that rupture for example which is newly formed, and occurs from violence or over-reaching in young and plethoric subjects, in whom there exists no pre-disposition to disease, and where only a single

turn of the gut is grasped by the stricture, is such as almost to forbid the trial of preventive means. This state is known by the urgency of all the symptoms, but especially by the excruciating pain caused by the stricture. The tumor is tense, red, and glossy, and exquisitely painful to the touch. In the space of one day the disease has often run its course. The inspection presents the signs of acute peritoneal inflammation, and the contents of the sac in a state of disorganization. In this case, the stricture of the alimentary tube and of its vessels is equally complete. The following, abridged from Pelletin, is a well marked case of this description.

CASE.

A butcher, æt. 28, of very strong sanguine habit, in lifting a mass of beef, was struck with a violent pain in his right groin, and at the same moment discovered a swelling there, oblong, and as big as his fist. Vomiting and

hiccough followed almost immediately. A surgeon, who was called, seeing the uselessness of attempting to reduce such a rupture, bled the man largely, and sent him to an hospital. The swelling was exceedingly painful, and the ring so constricted it, that it was as hard as a board; the taxis was not even thought of. The belly was sore to the lightest touch; and hiccough more frequent than vomiting. The man's faculties were disturbed by the agony of his sufferings; his face was flushed, his pulse quick and cordy; and he breathed as if panting. The dilatation of the stricture was performed with difficulty; a loop of intestine, found in the sac, was of a reddish brown colour, and covered with concretions of lymph. By the operation the pain was much relieved; the smallness of the pulse was thought to prohibit blood letting; the hiccough continued, and the belly became inflated and painful. He died twenty hours after the descent of the gut, and eleven after the operation. Upon examination the belly was tumid

the interspaces of the convolutions, reddened by inflammation, were filled with lymph; the portion of strangulated gut was black, collapsed, and did not seem a part of the canal. Little inflammatory effusion was present, but a great quantity of fluid matters filled the intestines.*

Such cases demand the operation on the instant of their presentation. Of the other remedies, full bleeding is the only one that offers any prospect of advantage.

Desault was of opinion that the taxis added greatly to the injury of the intestine; and his opinion was apparently confirmed by the result of a comparison of the success of the operations prior to which it had been used, with that of those in which it had been omitted. Some sources of fallacy however are discoverable in this mode of judging, and the opinion hardly admits of proof. The delay occasioned by repeated

* Clinique Chirurgicale, Tom. III. pa. 364.

trials at manual reduction is a more probable explanation of ill effects following the taxis; and I cannot give much weight to the opinion, notwithstanding its authority, seeing that so many cases are permanently relieved by this mode of proceeding.

Mr. Geoghegan, of Dublin, has objected to the usual method of applying the taxis: he deprecates all attempts to push back the hernia, directing his efforts to the evacuation of the strictured bowel. But whatever be the mode of proceeding, whether by pressure directed towards the ring, or perpendicularly upon the thigh, as Mr. Cooper advises in crural hernia, it must be clear to every one who reflects upon the subject, that the evacuation of the bowel precedes its return into the belly. It cannot be supposed that the operator's intention is to push back the bowel in its distended state, nor does the direction of the pressure towards the ring indicate such an intention; but that the air or matters in the part below may be more rea-

dily transmitted into the part above the ring. A great good effect of the taxis in addition to that before mentioned is, that it always of necessity evacuates the bowel before its return into the abdomen, as is known by the gurgling noise which first announces the reduction. The taxis is not so much misconceived in theory as misapplied in practice, as is proved by the recurrence to it on all occasions with equal expectation of its efficacy. Cases do not unfrequently occur in which either the warm bath and glysters, or simple compression of the swelling after its long exposure to cold air, will, if perseveringly continued, accomplish the reduction; but such cases must not be confounded with the strangulations of the primary species, which allow no time for such feeble and temporising expedients.

When a strangulated bowel is exposed to view, and the propriety of its return into the abdomen is confirmed by careful examination, there are two points of importance to be

kept in mind. The first is the evacuation of the gut by gentle but continued pressure before attempting to return it, for which purpose a moderate dilatation of the stricture will suffice. The second is the orderly and complete replacement of it, passing from one extremity of the loop to the other. Whether the gut or protruded omentum is first returned, seems to me a matter of less consequence. On the observance of order in the return of the bowel I have before insisted: its return in a state of collapse, not only materially reduces the requisite extent of dilatation, but by relieving its overstretched fibres, gives it a fairer chance of recovering its contractile tone. The idea which best conveys my notion on this subject is, that after the exposure of the bowel, the operator should continue to act upon the principle of the taxis.

The first consideration which offers itself to the mind of an experienced practitioner after the return of the bowel, is the evacua-

tion of the canal, which is of equal moment whether the signs of peritoneal inflammation are present or not. If such symptoms are not manifest, we are anxious to prevent their appearance; if present, to remove them. Venesection will not assist to obtain the end desired; although when evacuations are procured, the recovery of the patient is seldom accomplished without it, and often depends upon its employment. Fomentations should be diligently applied to the abdomen, and a purgative be administered in the first half hour's interval of freedom from vomiting. Half an ounce of the sulphate of magnesia may be given in the infusion of roses; a medicine which seems to be generally approved, and is perhaps the most active and the least offensive form for the occasion. It should be repeated hourly until stools are procured. "When the symptoms continue after the operation," says Dionis, "we should exhibit some doses of a laxative medicine, to conduct the matters through their accustomed channel." He adds,

that he has always done so with a happy effect, and that the vomiting immediately ceased when the patient had passed a stool. This is shewn by a case which occurred during his residence at Lyons, and which was the occasion of an operation by M. Parisot. The physicians in attendance taxed the surgeon with an imperfect operation, and insisted that he had not removed the stricture, because the young lady continued to vomit. They made her swallow shot, and afterwards quicksilver, in the quantity of three or four ounces. Dionis remonstrated, and explained to them, that the injured intestine was so debilitated by over-distention, that these ponderous substances would lodge in it, and burst it. He proposed the exhibition of purgatives, which were had recourse to ; by two doses the bowels were emptied, the vomiting ceased, and the patient recovered.

There is no good reason why a warm oily injection should not be administered at the close of the operation, and repeated every hour until proper evacuations

are procured. I confess myself an advocate for this practice, notwithstanding the light estimation in which it is held by some surgeons of eminence; and there are cases which sufficiently prove its efficacy and advantage. Such are those, among many others, of Jamieson, and Cookesley, related in the Medical Essays of Edinburgh.* But an observation of Louis places the expediency of the practice in the most striking point of view. He operated for a bubonocèle: the intestine was slightly inflamed; the operation was neither long nor difficult; in short, none ever promised a more happy result. The symptoms, nevertheless, continued precisely as before the operation, and the man died in less than twenty four hours. Upon inspection, the “large bowels were gorged with fæcal matters, indurated and in great quantity.” The patient would not permit the use of injections, either before or subsequent to the operation. “It appeared cer-

* Vols. I. and V.—See also Petit. *Traité des Maladies Chirurg.* Tom. II. p. 403.—Obs. par Gelibert. *Mem. de l'Acad.* Tom. III. p. 157.—Warner's *Cases in Surgery*. Case 39, &c. &c.

tain," says Louis, "from the healthy aspect of the piece which had been strangulated, that a brisk purgative would have rescued this man from the arms of death."* We are told that the parts to which the glyster is applied, are not implicated in the disease; but have not the contents of the large bowels been vomited for hours past? The truth is, we have no very correct notion of the nature and violence of inverted peristaltic action. I have seen an infusion of tobacco injected *per anum* and thrown up from the stomach in less than half an hour afterwards. If the natural movement of the intestines has been in any degree recovered upon the replacement of the extruded gut, the glyster will encourage it by its stimulating warmth, and facilitate the evacuation of the upper by emptying and cleansing the lower bowels; and that this is no unimportant service may be deduced from the well known sympathies existing between the extreme parts of the canal, and the quantity of scybalous matter commonly col-

* Mem. de l'Acad. Tom. IV. p. 309.

lected in the colon during a constipation of several days, which often precedes the strangulation *. I conceive that the effect of injections in exciting the natural actions of that part of the tract, where they are limited to it, which is below the valve of the colon, may be so propagated as to excite a series of such motions in the part above it; and that by a judicious and persevering administration of them at short intervals, they constitute a remedy of great value.

Upon the treatment of inflammation, I have nothing to offer in addition to what was said in the chapter on wounds. The case of Winterson well exemplifies the practice to be adopted.

The phenomena of a partial strangulation of the intestinal cylinder, a frequent and very instructive case, aptly illustrate the facts

* A surgeon in the army lately told me of the case of a soldier affected with an extreme irritability of the stomach, which induced frequent and painful efforts to vomit. He was freely purged, and afterwards took medicine to tranquillise this organ, but without success. In this dilemma, glysters were had recourse to, and by their use the digestive function was quickly restored to health.

already stated, and being for the most part complicated with gangrene, they may not improperly be premised to the consideration of that subject.

It is surprising how little inconvenience the patient has sustained, where the obstruction has been inconsiderable, and the strictured portion thrown off by gangrene. Hildanus met with a case, evidently of this description. Cases of preternatural appendices of the intestine becoming strangulated were first described by Littre, who has laid down peculiarities of symptom in partial strangulation, not in all cases to be depended upon. In fact, the constitutional affection is always proportioned to the extent of the strictured part, or at least to the interference of the stricture with the intestinal function. If the peristaltic action is little interrupted, and consequently the passage of the aliment not materially impeded, the symptoms are purely local, and Nature herself completes the cure. But if the reverse is the case, and the intestinal function is deranged, constipation,

abdominal pain and tension, nausea, vomiting, and fever ensue, and with the occasional exception of hiccough, the symptoms are not to be distinguished from those of a stricture of the entire cylinder. I have seen a case of this kind prove fatal, in which with the stated exception the symptoms of obstruction were complete, and although of short duration, were thought too far advanced for relief from an operation. No suspicion of the real nature of the case was entertained. Upon examination after death, the ileon was found strangulated and sphacelated in one half of its diameter. This case strongly impressed my mind with a belief, that if by good fortune a barber surgeon mistaking the disease had pushed his lancet into the swelling, the patient, who was a healthy middle-aged woman, would have recovered. In further proof that the opposite states of constitutional affection above mentioned do accompany this partial strangulation of the cylinder, I offer the two following cases.

CASE I.

An aged patient of La Salpêtrière, had a reducible rupture, and as he wore no truss, was frequently teased with cholicky pains, which ceased upon restoring the gut to its place. In January, 1750, this mode of relief failed, and he accordingly purged himself with jalap. Though the medicine operated well, the rupture inflamed and went on to gangrene. When Louis, who reports the case, was called to him, the gangrene had extended a palm in breadth, and from five or six holes in the dead skin the excrement was discharged. *He had neither fever, nor nausea, nor vomiting.* The proper dressings were attentively applied, and the patient was nourished by good broths, and took half a glass of wine morning and evening. Injections were likewise given twice daily. As the wound filled, the fæculent discharge fell off in quantity.

Eggs, and a diet of more consistence, were allowed, and the cure was completed in a month.*

CASE II.

A porter of Bologna was brought into the hospital of that city with a swelling in his right groin, not larger than a man's thumb, which had existed six days. His flesh was cold, his pulse very frequent, but small, and giving little resistance to the finger; his belly as tight as a drum. He threw up his food. For four days he had passed no stool, and it was in vain that he endeavoured to pass flatus: fresh drawn oil of almonds was given him, and oil of linseed thrown up by way of glyster. Both were rejected. He was exceedingly thirsty, and compared the taste in his mouth to that of a poison. On the seventh and eighth days the glysters were repeated, but were of no more use than the former. As no excrement was discharged, and the other symptoms continued,—the

* Mem. de l'Acad de Chir. Tom. III. pa. 148.

pulse becoming weaker and smaller, till on the ninth day it could hardly be felt at all, the skin corrugated, the body cold, the patient unable to lift up his eyes—he sunk and died on the night following. When the abdomen was opened twenty four hours after death, the omentum appeared extended quite into the hernia, and red from inflammation. The stomach stretched itself more than usual to the right side, being universally distended with fluid excrement, with which the small intestines, from the stomach quite to the hernia, were also distended to a very great degree. “For whatever used to be carried from the ileum to the large intestines remained there, and was collected in great quantity, and the large intestines were all very much contracted and white, so as to make it manifest that nothing had passed through this part of the ileum which belonged to the hernia ; although the tube of the intestine itself did not enter the orifice of the sacculus, but passing by the side of it, sent no other part of itself into that cavity,

but a portion of its paries relaxed into the form of a semi-oval cavity," measuring three inches in its larger axis and adherent to the sac.*

De Haen ascertained this form of the disease in a young merchant, who fell a victim to it on the third day from the attack. The tobacco smoke availed nothing; and the patient obstinately persisted in refusing his assent to the operation. De Haen examined his body. "*Intestini ilei ad pedis circiter a valvulâ Bauhinianâ distantiam porro, dimidiâ suæ diametri parte intra herniam erat, reliquâ vero sui portione in abdomine; non accreta aut omento aut sacco suo †.*"

From these contrasted cases it appears clearly, that the effect of the local injury is so slight as not to expose the patient's life to hazard, if it permit the passage of the aliment; and if on the other hand it be combined with the symptoms of obstruction, the

* Morgagni Lett. XXXIV. Art. 18.

† Ratio medendi, Cap. 4. De Herniis.

event is equally to be apprehended with that of a stricture of the tube in its whole diameter. The extension of gangrene to the integument in such cases, is a fortunate occurrence; and this effort of nature for relief reads an impressive lesson to the surgeon. Had Morgagni, instead of giving medicine, made an opening into the gut on the man's admission into the Hospital, it is more than probable that his symptoms would have been permanently relieved. The treatment of these cases, when they have required an operation, has been similar to that of mortification affecting the cylinder. Some, having removed the stricture, leave the sphacelated portion connected to the wound by a ligature of the mesentery; others excise the corresponding portion of the tube, and adopt one or other of the methods hereafter to be described.

The mortification of an intestine was formerly considered to be a case utterly desperate and hopeless. “*Si intestinum lividum, (aut pal-*

lidum) aut nigrum est, quibus illud quoque necessario accedit, ut sensû careat, medicina omnis inanis est.”*

Louis observes, that up to the commencement of the last century Art was at fault, and every thing was expected of the resources of Nature ; and adds with perfect correctness, that though the circumstances of some cases are so fortunate, that they might be safely delivered over to Nature, there are others in which such a confidence would be misplaced.

There is a story told of the celebrated lithotomist Rau, by his pupil Heister, which strikingly confirms the observation of Louis. They visited together, in the year 1707, a poor shoemaker, who had a rupture five days strangulated.

“ We found the patient,” says Heister, “ in a very dangerous way, being extremely weakened by continual vomiting, and the severe pains he had endured for the last five

* Celsi. Medic. Lib. 7. Cap. 17.

days : his pulse was languid, and his sweats cold ; he was yet very desirous to be helped and willing to submit to any thing to save his life." (Here follows the description of the operation.) "Through this orifice he passed his grooved director, ('sonde creusse,') into the sac, cutting the hernia above and below the aperture its whole length : which when he had finished, he perceived that the protruded intestine was already quite black and destroyed, for which reason he would not proceed any further in the operation, but told the patient he must die ; then putting up his instruments went away without advising or undertaking any thing more ; and at ten or eleven that night, the patient died.*"

We are commonly cautioned against sanguine expectation by more modern writers, who only tell us of them to prove the possibility of such events, and add that gangrene of a bowel is generally fatal. But I confess that my fears of gangrene properly treated,

* Heister's Cases by Wirgman. Obs. 33.

are less than of that previous change, in which the propriety of reduction has never been questioned.

It has been considered a matter of some difficulty, to ascertain the presence of gangrene where the bowel retains integrity of texture, and various tests have been recommended for this purpose. I am well convinced that in the absence of other criteria, no accurate distinction can be drawn from the several shades of color which an intestine presents at different periods of strangulation, but there is a sign which I believe may be regarded as unerring. This is that loss of lustre which accompanies the death of polished membranous surfaces, and which alters the complexion of the peritoneum as it does of the cornea.

Of partial gangrene of the Intestine.

Mortification, when appearing in circumscribed spots or patches, is not now

considered to be a state disqualifying the gut for its return into the abdomen. Examples of the success attending reduction in this state, have been furnished by De Hautesierk,* Goetz,† Watson,‡ Desault,|| and Long. § In Desault's, and some others of these cases, the slough has fallen into the canal, which materially simplifies and quickens the process of restoration.

Of gangrene affecting the Cylinder.

Louis has been at much pains to discover the origin of the practice of uniting the sound extremities of an intestine after excision of the gangrene, by the insinuation of a cylindrical substance. It appears from

* Obs. de Med.

† Journal de Med. t. xxxvi.

‡ Med. Commun. vol. ii.

|| Paris. Journal, vol. ii.

§ A Treatise on Ruptures, by William Lawrence, second edition, pa. 272.

a passage reprobating the practice in the surgery of Fabricius ab Aquapendente*, and another to the same purport in Guy de Chauliac †, that various substances had been proposed, if not tried, by their predecessors and contemporaries. The use of a calf's trachea appears to have originated with the traditionally famous Quatre Maitres, who flourished at Paris towards the conclusion of the thirteenth century. The ant's-head suture recommended by Albucasis, Louis has most irreverently neglected to notice.

M. Littre ‡, after describing, as a new species of hernia, the strangulation of a pre-

* Sunt nonnulli inepti, qui antequam consuatur intestinum, cannulam immittunt vel e sambuco vel portione asperæ arteriæ alicujus animalis, vel ex alio intestini frustulo ne suturæ ciborum transitû dilacerentur; his quippè putrefactis, æger interficietur, ideòque pessimum hoc consilium fugiendum. De vulneribus, cap. 26.

† Natura intenta ad alienorum expulsionem, expellit & removet illa de suturâ, & ita perit finis pro quo talia applicantur.

‡ Obs. sur une nouvelle espèce de Hernies. Mem. de l'Acad. roy. des Sciences. An. 1700.

ternatural appendix of the ileon, which he had met with in two cases, proposes that if the gangrene of the appendix extends to the gut, the affected part should be excised; the ends being retained until the ventricular was distinguished from the intestinal portion, which being accomplished, the latter was to be tied and put back; the former to be brought to the parietal wound, and there retained, by three stitches at equal distances, passed at three lines from its margin. In healing the wound, the surgeon is directed to keep a permanent aperture equal to the diameter of the gut, which adheres to its circumference; that no obstacle may be opposed to the excrementitious discharge, which is ever after to pass by this route.

Accident threw a seemingly better practice into the hands of M. Peyronie. Having removed the gangrenous piece, in operating upon a man 35 years of age, he was unable to distinguish the ventricular from the in-

testinal end of the bowel, and thought it safer under such circumstances to keep them both at the wound by a loop through the corresponding portion of mesentery. He expected no more than Littre, and was willing to compromise with Nature. But, as if availing herself of an opportunity for the exertion of her powers, the canal was restored in one month, and the cure was perfected in another. An occasional cholic troubled the patient for two years afterwards; and owing to the free dilatation of the hernial aperture, another descent took place. Encouraged by this unlooked for union, Peyronie had recourse upon another occasion to the same practice; but the event was far from encouraging. The *fæces* being abundantly discharged at the wound, the symptoms of disorder subsided. The matters were after some days divided between the new and the old passage. The progress of healing was disturbed by the quantity and consistence of the aliment. It was not until four months had elapsed, that the

wound was healed by keeping the patient upon a very light and spare diet. Six months afterwards, lancinating pains in the part announced the formation of an abscess; the stercoral discharge was renewed, and a small bone voided, which was supposed to have caused the mischief. Two more months were occupied in healing up the wound a second time. Gradually a new hernia formed at the site of the cicatrix, but this was not the greatest misfortune; for the patient remained ever after subject to violent cholic, from obstruction to the passage of food at the point of union *.

Ramdohr's operation is well known. His patient was a female, who had a strangulated crural hernia. Having excised the sphacelated portion, he inserted the upper sound extremity within the lower, confining them closely by a suture in that position. In this state he reduced the gut, connecting it by the end of the suture to the wound. The matters

* Mem. de l'Acad. Tom. III. pa. 170.

soon passed *per anum*, and the woman recovered. A year afterwards, she died of a pleurisy. Ramdohr examined the united intestine, which he found adhering to the parietes. Heister, to whom he presented it, informs us, that he preserved it in his Museum to convince the incredulous.

Duverger, having amputated two fingers' length of spoiled intestine, introduced within the sound pieces a portion of trachea, so that its barrel should support them in connection. Each extremity of the tube was prepared with three threads, passed at equal divisions of its circumference by as many curved needles, with which he carried stitches, from within outwards, through the coats of the gut, at the distance of four lines from the lips of the wound. The intestine was then fomented, and put back into the abdomen. Next day, the patient had a violent paroxysm of fever: this was quieted by two small bleedings, and a natural stool. The belly continued open, and the hiccough and vo-

miting ceased. On the twenty-first day, the rings of the trachea were seen in the stools, up to which time the patient had been rigidly dieted upon very thin broth. The external wound was completely cicatrised about the forty fifth day, and the patient remained in all respects well.*

Of the two cases of M. Peyronie, it is worth while to remark that the wounds were healed with difficulty, and that the pain and hazard sustained during the remainder of life were so considerable, that the practice could scarcely be considered as an improvement on the artificial anus of Littre. His first patient, Louis informs us, ultimately fell a victim to obstruction. Accordingly we find him, in succeeding cases, leaving Nature to operate for her own relief. M. Dubertrand, in a case of hernia, accidentally complicated with wound, adopted the practice of Peyronie. The woman, by very rigid precautions, dragged on a painful existence for three years, when the cicatrix opened

* Lib. cit. Tom. III. pa. 188.

afresh, and gave rise to a fæcal tumor as big as a man's fist. She was exhausted by the slough which ensued.*

The practices of Ramdohr and Duverger are each supported by an insulated case, and so far as such limited evidence can be admitted upon a point so important, they are unquestionably entitled to attention. But of the former the history is defective: little more than the bare fact of union is stated, and even this we have at second hand.† Add to which, the patient survived only one year. Duverger's case was communicated to the academy ten or twelve years before Louis wrote on the subject, and it admits of no exception on the ground of deficient detail. If it can be depended upon for accuracy, its result is perfectly satisfactory, though it must be considered an instance of good fortune, in which the patient recovered, a violent attack of fever following the operation.

* Lib. cit. Tom. III. pa. 173.

† Moebius in Haller. Disput. Anat. Vol. VI.

The operations of Littre, Ramdohr, and Duverger have excited much speculative criticism. The first was a mere project; for it is obvious that the difficulty which deterred Peyronie from adopting it, would always present itself, to wit, the impossibility of determining the ventricular portion of the intestine. Littre's marks of distinction are altogether fanciful. Precisely the same objection holds against the methods of Ramdohr and Ritsch,* who attempted to improve upon Duverger, while Louis's proposal is at least as objectionable as that which it professed to correct. This was to retain the extremities at the wound and exhibit a purge.

To all these practices there is a rational and unanswerable objection, founded on the displacement and handling of the sound parts, and the tediousness and complexity of the operation, at a time when, as Petit says, it is peculiarly an object to relieve, without dis-

* Mem. de l'Acad. Tom. IV. p. 173.

turbing Nature in her functions. I must remark however, that the success by which these cases have been followed is distinctly attributable to the free discharge obtained at the wound before the artificial connection was set up: an object to which all others are subservient.

Le Dran reports an operation, in which, finding a foot's length of gangrened gut tightly strictured, two fingers' breadth above the ring, he with difficulty dilated the stricture, which was formed by bridles crossing the sac, and opened the bowel to discharge its contents. The stricture however was still sufficient to impede the escape of the matters, so that hiccough and vomiting continued until the third day. He afterwards obtained free evacuations by introducing a sound into the portion of intestine which corresponded to the stomach. The case terminated in artificial anus*.

* *Observ. de Chirurg. Tom. II. Obs. 60.*

Mr. Cooper in his valuable work presents us with four original cases of mortification of the intestine. The practice which he adopted in the first was that of passing a ligature through the mesentery of the mortified gut, so as to confine it to the mouth of the sac, and then opening the bowel to discharge the fæces. The man was in a dying state at the time of the operation, from the long continuance of the stricture, and did not survive another day. In the second operation, performed on the eighth day of the disease, Mr. Cooper simply dilated the stricture, and made an opening into the mortified part, leaving it to slough. This patient's strength was likewise so completely exhausted by the disease that she survived only two hours and a half. In the third operation, also done on the eighth day of the disease, the mortified portion of intestine was cut away, and the ends joined by three sutures, so as to leave a small opening for the discharge of fæces, and by the

suture which passed next the mesentery the gut was confined to the mouth of the sac.

The following is the account of the symptoms and appearances on inspection.

“ Nov. 8th. During the operation, she vomited frequently, but only once after it was concluded; pulse 108, and languid; thirty drops of tincture of opium were given her. In the evening the vomiting had ceased; the abdomen was less tense and painful; the pulse about 112; tongue dry and furred; countenance distressed; eyes frequently rolled upward; extremities warm. She had not slept, although she had taken a grain of opium, in addition to the thirty drops.

9th. The vomiting had not returned; abdomen soft; slight pain in the stomach; the wound discharged freely a fluid similar to that which she had previously vomited; no evacuation *per anum*, and whatever she drank escaped in a few minutes at the wound; pulse 130; had not slept.

10th. Every symptom as above, with increasing debility; tongue very brown; skin hot; complained much of want of rest, and an opiate was given her. The nourishment she took, consisting of tea, broth and porter, was speedily discharged at the groin.

11th. She remained very much in the same state except that the debility every hour increased. She died on the morning of the 12th, sensible, and complaining of pain in the abdomen.

Examination.—Abdomen flaccid; integuments over the artificial anus livid, but not mortified; stomach pale and contracted; small intestines, between the stomach and protruded intestine, inflamed. The ileon was the protruded intestine; and it was its upper part which had descended: below, to the cæcum, it was pale and contracted: large intestines not inflamed. No effusion, nor any adhesion within the abdomen; but the protruded intestine was firmly glued to the inside of the sac.”

The operation in the fourth case was done on the evening of the fourth day from the commencement of the symptoms. The patient, a female, 68 years of age. I shall give the detail of the operation in Mr. Cooper's words :—" I next dilated the stricture, and thought, whilst doing this, that I could perceive a small portion of intestine within the orifice of the hernial sac ; and securing it between my finger and thumb, I carefully dilated the orifice of the sac. I then drew forwards the substance which I held, and found it to be a portion of intestine, about the size of the end of my finger, and about three quarters of an inch long, of a very dark colour, and it had two small holes in it, one which would almost admit the blunt end of my probe, and the other only the point. Both these holes were circular, and passed through the coats of the intestine, so that fæculent matter escaped through them when I pressed upon the portion of bowels adjoining

to them. It now became an object of consideration to determine what should be done with this perforated portion of intestine. It might either be sewed to the sac, and left in that situation, so as to allow of the escape of the fæces, or it might be returned into the cavity of the abdomen, or a portion of it might be cut away, and the ends united. I preferred the latter mode; therefore, spreading the portion of the strangulated intestine in my hand, with a pair of scissars I cut off the sphacelated piece, and then made three sutures upon the intestine to bring its edges together. The intestine was then pushed as near as possible to the mouth of the hernial sac, and the threads left hanging from the wound; the protruded omentum was cut off, and the edges of the wound were brought together every where, except in the centre; so that if fæculent matter did escape from the intestine it might pass through the wound, and be prevented from being effused into

the cavity of the abdomen." This operation was done on the last day of July. The woman had a permanent artificial anus, and lived till the 9th of October following. All symptoms of irritation quickly subsided when the discharge was established; but the patient became enfeebled by the quick evacuation of the aliment, which passed off, both solid and fluid, very little changed, in the space of an hour. At one time an obstruction took place in the aperture of the intestine, and the symptoms of tension, pain, vomiting, &c. returned. They were relieved by a copious fæcal discharge, but she never recovered her former strength. The abdomen, on examination, was free from inflammation. The lower part of the ileon formed the anus. The large intestines had shrunk to a very small size; and the orifices of the intestine were likewise small, especially the lower.*

* *Anatomy and Surgical Treatment of Crural and Umbilical Hernia. Chap. VII. pp. 28—32.*

These last are very instructive cases. In the former it is evident the powers of life were already sunk below the rallying point. From the two last mentioned cases it appears that notwithstanding the complete sphacelus of a part, peritoneal inflammation had not existed; and when we consider the duration of strangulation, and the severity of symptoms in the former, and the age of the patient in the latter case, it cannot excite surprise, that they should have sunk under a state of exhaustion from the very imperfect nourishment of the system.

In all the cases to which I have hitherto adverted, more or less has been done by the surgeon: he has not been simply a spectator. In all, the stricture has been dilated. In some, the dead part excised, and the extremities confined by a ligature of the mesentery: in some, they have been partially connected by sutures; in others, wholly. In two instances, an opening has been made into the mortified gut after the division of the stricture.

Let us now enquire a little into the history of those cases in which the surgeon has been more diffident of his art.

CASE I.

A woman, who had been troubled with a crural hernia fourteen years, suffered a strangulation of it with all the accompanying symptoms. These were urgent, and the operation was resorted to. Gangrene had extended to the sac, which contained omentum and a loop of intestine, all adhering intimately. To destroy the adhesions would have been impossible; and the operator therefore contented himself with removing the strangulation by dilating the crural arch. From the low state of the patient, her life was for some days precarious; the little strength which she retained was supported by a cordial drink. At length the belly became soft; the remaining eschars were detached, and on the eleventh day from the operation, the whole

loop, five inches in length, was separated. From this time the stercoral matters, which had passed partly by the opening in the gut and yet more by the rectum, were suspended altogether by the latter route, and made their escape at the wound. Very frequent dressings were required, five or six in the twenty four hours. The wound became clean and florid; and at the end of four months its sides were so nearly contiguous, as to leave only an aperture equal to the extremity of the little finger. No expectation was entertained that the artificial anus would be healed; but things took a sudden and unexpected turn. The woman relaxed from her strict regimen, and induced pain and fever. Her surgeon, M. Pipelet, gave her a brisk purge, and it operated naturally. The wound in the groin healed in a few days; and when the account was written, the patient had attained her 72nd year, having since enjoyed sixteen years of undisturbed health*.

* Mem. de l'Acad. de Chirurg. Tom. III. pa. 178.

CASE II.

A young woman, whose efforts in labour had caused a femoral hernia, was three years after attacked with symptoms of intestinal obstruction; and having in vain attempted to conceal it, submitted to an operation on the fourth day of the strangulation. When the sac was laid open, there appeared two inches of sphacelated intestine, from which fæcal fluid passed abundantly. After about a pint and a half had been evacuated, the patient, whose sufferings were dreadful, found herself much relieved. The parts were then cleansed, washed with a spirituous embrocation, and covered with light dressing. In three hours the dressings were completely drenched by the discharge, and from that time, for fifteen days, required to be changed five or six times daily. The suppuration nevertheless, was of a good sort, the granulations began to cicatrize, and at the end

of a fortnight a part of the matters took their natural course. In one month they passed entirely *per anum*, and the cicatrix was soon completed. A very strict regimen had contributed to this early cure, which had been in consequence retarded by no accident. But when another month had elapsed, some attacks of indigestion and cholic pain came on, one of which was followed by strong efforts to vomit. In one of these efforts a severe pain was felt in the region of the cicatrix, the belly became more and more painful, and swelled prodigiously. Next day the woman died, and her abdomen was found full of fæces: they had escaped through a fissure, eight lines long and three broad, in the line of union, the superior extremity having been lacerated from its adhesion to the peritoneum lining the crural arch; the inferior retained its attachment to the same part.*

I have now exhibited two cases of natural cure, and neither of them solitary, but

* Mem. de M. de la Peyronie, Lib. cit. Tom. I. p. 342.

together affording all the practical illustration which the subject has received. In both, as in all such cases, the relief of the symptoms by the discharge is sufficiently manifest. But in the former, the matters never entirely quitted the natural channel, until the sphacelated portion of intestine was cast off. The discharge at the groin was encouraged. For four months, no attempt in any way was made to restore the intestinal office, until the smallness of the aperture in the groin giving rise to obstruction, the exhibition of a single purgative medicine effected the restoration.

Now in the last cited history, a rapid but very unfavourable union, i. e. an union accompanied with great contraction, was brought about, of which it followed as an intelligible consequence, that the common aliment (for it does not appear that any excess or improper diet had been indulged in) was retained at the point of union, and tore open the recent adhesion

under the effort of vomiting. This, and similar events led some to recommend accustoming the patient in the early days of treatment to a solid diet, a short-sighted and dangerous practice, grounded on the supposition that it was the consistence of the aliment which determined the size of the newly formed canal. I consider these cases as strongly exemplifying the remarks made at pp. 157-8, to which I refer the reader. If the patient is nourished, and the constitutional irritation subsides during the preternatural discharge, this discharge should be rather encouraged than suppressed, and we should refrain from all attempts to quicken the healing process. We may rest satisfied that an effort at restoration will in due time be made, which, if not of itself sufficient, a very slight observance of the indication will render so, as in the case of Pipelet.

I shall conclude this chapter with a concise summary of the opinions of those writers, who, though they have not been the authors

of new devices, are entitled from their experience and deserved reputation, to be heard upon a point of so great difficulty and importance. And of these there is none entitled to higher respect than the celebrated J. L. PETIT. The result of his experience is, that the cure of those cases is due more to nature than to art. ‘Happy,’ says he, ‘are the patients of those surgeons who, convinced of this truth, confine themselves to the removal of all that can trouble or interrupt Nature in her functions.’ Those, he observes, whom he has seen perish, having a gangrene of the intestine, with an opening, and consequently a discharge of the fæcal matters, have not died either of one or the other of these states. If all the fæces pass by the wound, the worst effects that can follow from this cause are pruritus and pain, which are not mortal; but an effusion of the matters into the belly necessarily proves fatal. He concludes with the assurances of his experience, that it is not the opening

of the intestine which causes death ; for, where she is equal to it, it is Nature's mode of relieving herself.*

LOUIS, whose admirable essay on this subject I have so often cited, objects to the incision of the ring where the intestine is adherent. He advises that the gangrenous parts be removed, leaving the sound untouched. Where the gut has contracted no adherence, whether a smaller or larger part of the whole diameter of the tube is included in the stricture, he recommends its removal and the union of the sound ends, according to the manœuvre of Ramdohr, unless the adhesions render their complete approximation impracticable, when an artificial anus is to be preferred.

GOOCH, a surgeon of high character, writes thus:—‘ When we happen to be called too late, and there are evident signs of the intestine being in a mortified state, it appears to me upon reflection, very war-

* *Traité des Malad. Chirurg. Tom. II, p. 403-4.*

arrantable and reasonable practice, supported by some of the cases I have been mentioning, and the observation of others, *to make an incision into the tumor, ample enough to evacuate the fæces freely*, which may effectually remove the strangulation of the intestine at the abdominal ring; and then to treat the wound as a mortification, not being over busy with the knife, in cutting away what appears to have lost its vitality; but allowing nature to throw off the mortified sloughs by the granulations of flesh, which may well supply the loss of substance, as I have seen by such management, far beyond my expectation. When it is a doubtful point what condition the parts contained are in, we must proceed with great caution in this operation, till we come at the intestine; and finding that mortified, it is to be opened, and the stricture removed by incision at the muscular ring, should not the evacuation of the fæces do that effectually*.

* Chirurg. Works, pp. 214, 215.

SHARP advises the cutting away of the gangrene, whether of the intestine or omentum. He says that the surgeons of his day have surmounted the prejudices of their ancestors ; for seeing small gangrenes do well, and some instances of recovery where the slough of the integuments had permitted the evacuation of the fæces, they concluded that if the mortified part was cut off, the strangulation removed, and a free issue given to the fæces, the patient might probably survive who otherwise would perish. He advises the union of the living intestine by the interrupted suture, or if this cannot be done from their adhering or lying unaptly, it is to be confined by a stitch to the borders of the wound ; from which time the extremity of the upper portion becomes an artificial anus *.

RICHTER, whose treatise on Hernia discovers a profundity of research, and an extent of personal observation in his time

* Critical Enquiry, pa. 37-8.

unparalleled, is elaborate in his discrimination of the several stages of gangrene and the treatment which they respectively demand. If a suspicious spot appears upon the surface of a strangulated gut, he reduces it with a ligature of the mesentery. If it penetrates the coats of the bowel, and the intestine adheres, he dilates the ring ; but instead of reducing the gut, leaves it in the sac. If the gut so affected is loose and unadherent, he fixes it by a ligature on the outside of the ring, and cuts away the dead part, leaving only a sphacelated margin to be separated by nature. On the second day he reduces it, taking care to place the opening exactly behind the ring. If only a part of the circumference of the gut is strangulated and in a state of gangrene, he leaves it wholly to nature, refraining from the incision of the stricture. If many small spots and small openings appear in the strangulated intestine, he adopts the same practice ; but if they are extensive, as well as

numerous, he excises the whole piece, and treats it as if totally gangrened. When this is the case, he excises the dead part, and if unadhering, confines the sound extremities by a ligature to the mouth of the wound. He then clears the canal by means of a purgative and a glyster, and leaves the ultimate disposal of the parts to Nature.

POTT recommends the confinement of a partially sphacelated bowel to the wound by a strong ligature of the mesentery, to secure the external discharge of the fæces when the eschars separate. If the altered portion is so large as to require excision, he advises the suture. "The ends of the intestine," he says, "should be made to lay somewhat over each other, by which means the suture will be the stronger." The ends when sewed together, are to be fastened to the inside of the belly, at the upper part of the wound. If the disease is of such extent as prohibits the bringing of the ends together, each portion is to be connected by a

* *Traité des Hernies*, Chap. XXVIII.

proper needle and strong ligature to the upper edge of the wound, in such a manner as to preserve the mouth of the gut free and open, considering it impossible in this case to preserve the continuity of the canal*.

CHOPART and DESAULT accord with the last mentioned writer upon the treatment of an intestine with small spots of gangrene; but if they are broad patches, they advise in addition, to open the gangrenous part, and give issue to the matters accumulated above the stricture, lest their weight upon a part incapable of resistance should cause effusion†.

SABATIER likewise recommends this practice when the gut is strictured only in a part of its diameter; and he objects, with Louis, to the operation of dilating the stricture, when the inflammation which it had occasioned has degenerated into gangrene. When the bowel forms a loop in the tumor, these authors consider it to be uni-

* Works, Vol. I. pp. 135, 136.

† *Traité des Malad. Chirurg.* Tom. III. pa. 272 & seq.

formly free and without adhesion to the parietes, and recommend that enough of it should be drawn into view, to determine the extent of the gangrene; that the spoiled parts should then be excised, and the ends brought together by stitches upon a cylinder of card in the manner of Duverger, with some trifling modifications *.

It would be an useless repetition to detail the opinions of modern writers and teachers. Their discordance with each other, and in general with those which I had formed, was a principal motive to the present publication. To Mr. Lawrence, of Bartholomew's Hospital, who has distinguished himself by an excellent Treatise on Hernia, is due the credit of having revived the opinions, neglected or forgotten, of the illustrious Petit. I have been informed by an intelligent pupil of Mr. Blizard, that the incision of the mortified intestine was recommended by that gentleman in his Lectures on Surgery.

* Med. Operat, Tom. I. pa. 109 & seq.

CHAPTER VIII.

EXAMINATION OF THE PRACTICE GENERALLY ADOPTED IN MORTIFIED HERNIA—THE AUTHOR'S OPINIONS AND PLAN OF TREATMENT—CASES—EXPERIMENTS SHEWING THE PROCESS OF UNION AFTER SPHACELUS FROM STRICTURE—THE ARTIFICIAL ANUS AS A CONSEQUENCE OF HERNIA.

FROM the summary of facts and opinions now before us, it appears that very dissimilar methods of treating the intestine in a state of gangrene have had their respective advocates. At this day opinions are unsettled, not so much from deficiency of opportunities to decide them, as for want of an accurate knowledge of the intestinal pathology, and a due deliberation on the evidence in hand. There is however a difficulty attending decision on such points, from the occasional

instances of success obtained by opposite plans of treatment. The operose manœuvres of Ramdohr and Duverger have sometimes succeeded as well as the simple but scientific practices of Petit and Gooch. But the history of the healing art is abounding in examples of discordant results; some really so, and to be explained only by an appeal to the extraordinary exertion of the natural powers; but a far greater number only apparently irreconcilable, from a deficiency of observation in those accustomed to witness them.

The situation and connections of the strangulated bowel demand our first attention. We must bear in mind that in a complete strangulation the tube forms a double within the abdominal opening; that whether the stricture is formed by a tendinous aperture, or by the neck of the sac, the folds are in close contact where they are embraced by the stricture; and that uniformly and without exception, the peritoneal tunic of the gut ad-

heres to the peritoneum of the parietes at its margin. I state these points distinctly, because the hypothetical notions which have been entertained by writers have been made the basis of practical distinctions. Thus we are advised by most respectable authors to tie the mesentery to the wound, when the intestine has contracted no adhesion to the parietes, and to refrain from attempting to preserve the canal, or in other words, to form an artificial anus, when the parts included in the stricture are so distant as not to admit of being brought into contact. I am convinced from observation of the disease, and the effect of a stricture upon the intestines in artificial imitations of it, that the strangulated gut is always fixed by adhesion where it quits the belly, and that this adhesion creates much of the impediment commonly experienced to the return of the gut in the operation. If the stricture is of the primary species, the adhesion is recent, and opposes little resistance : in the secondary strangulation it is

often quite impossible to overcome it; and the bowel must remain in the sac. In all cases it is fully sufficient to hold the intestine in its place. It follows upon this representation, that the distinction taken from the extent of the protruded part is delusive, and that the ligature is at least superfluous. The natural relation between the parts of the tube included in the stricture can only be determined by the extent of the part protruded, since these must form its extremities. But if the jejunum and sigmoid flexure of the colon were included in the stricture, they would be securely retained there without artificial aid. This adhesion is the result of inflammation of one or both surfaces, by whatever cause induced. I have no conception of the possibility of adhesion without inflammation. In reducible hernia the sac has a wide mouth; and no stricture having been formed, no inflammation has taken place. But upon tracing the history of an irreducible rupture, we shall find that

it has been once if not often in danger of strangulation, that the patient has at different times laboured under constipation and pain ; and these temporary obstructions have induced an inflammation of the peritoneum, terminating in adhesion, such as happens between the costal and pulmonary pleura after pneumonic inflammation.

The next consideration is the state of the intestine. It is either fit or unfit to be replaced. That much fallacy attaches to the common diagnostics is proved by the cases upon record, in which the discolored intestine has been returned, and after some days has sloughed and discharged its contents at the wound*. Cases have occurred too of a contrary description, in which, although the operator despaired of the recovery of the bowel from the change which it had undergone, it has speedily re-

* Le Dran. Obs. 59.—Haller Disput. Chirurg. Tom. V. p. 77.—Cooper's Hernia, Part I. p. 35, and a case by Mr. J. H. Birch, Surgeon, Nottingham. Lond. Med. Review, No. XVI. p. 372, &c. &c.

sumed its functions. If the gangrene is circumscribed, and affects only a part of the cylinder, whether one or more spots appear, it will be thrown off at the wound, or separate into the canal, without risk of effusion into the belly. If the texture of the part is more extensively destroyed, i. e. uniformly gangrenous, or burst in many places, the whole piece so affected will separate. Now in this case the custom has been to divide the stricture, to draw forward the sound parts, to excise the whole of the dead piece, and to approximate or connect the extremities by one or more sutures, with a view to the re-establishment of the canal. I shall consider these several stages of the operation.

The division of the stricture where an intestine is in a state to resume its function is indispensable; but the object of the division where an intestine is mortified is to me unintelligible. It is in fact no longer a stricture; the resistance which rendered it so is taken off by the collapse of the

included gut, and the patient can experience no greater relief from the division than the part itself. Nature has anticipated the surgeon; being unable to dilate the stricture, she has accommodated herself, as her custom is, to the circumstances of the case, and accomplished by other means the object of the operation. The gut has been liberated at the expence of its vitality. It may be supposed that the incision of the stricture is essential to the discharge of the matters at the wound: but this is plainly not the fact; for in every instance in which the intestine has given way previous to the operation, we find that the sac or the integuments were loaded with fæcal matter: and further, where the incision of the stricture has been performed, the discharge has sometimes been so copious as alarmingly to exhaust the patient's strength. But it may be thought essential to the union of the intestine that the stricture should be divided; on the contrary, in this respect it is seriously prejudicial.

Whatever be the intention of the surgeon, the dilatation of the stricture within the sac necessarily separates the parts in contact, and the introduction of the finger or the director destroys more or less of the adhesion which surrounds and retains them. It is a prevailing custom with operators, even when the gut is mortified, to dilate the opening which formed the stricture ; and I have witnessed a solicitude to destroy the adhesions by carrying the finger round it, when the dead and bursten gut was to be left to slough at the wound. It should be remembered, that next to the immediate relief of the symptoms which threaten destruction to life, is the object of ensuring the union of the severed intestine. Now the natural disposition of the parts is the most favourable for union which they could possibly assume, vastly more so at least than any which we can give them *. The stricture is the

* This fact is well demonstrated by Pl. VII. Fig. 2. in the fourth Fasciculus of Dr, Baillie's Morbid Anatomy.

medium by which they are held in contact, the line of demarcation between the dead and the living parts with which that of union corresponds. If the stricture were more definite, and resembled more that formed by a ligature, the processes of separation and union would be quicker and more certain. If therefore we divide the stricture, we slacken the process of ulceration, as would be the case, if instead of daily tightening, we relaxed the horse-hair at the basis of an excrescence: the ulceration becomes spreading and irregular, which would otherwise be defined and accurately cylindrical; and what is still a greater evil, the parts are thrown to a distance from each other, which were before in actual contact; and thus, if we do not induce a permanent artificial anus, we render the event of union tardy of accomplishment. I shall further illustrate this point in speaking of the mode of union.

If any reliance is to be placed upon the arrangements of nature, if the adhesion

by which the parts are cemented is salutary, the practice of drawing the sound intestine into view must be injurious. But the object of this exposure of the sound parts is to excise the dead piece and unite them. When Nature has destined the separation what advantage is gained by this interference? Is such a practice warranted by analogy? Few surgeons of experience will presume to interfere with Nature in the removal of a limb in a state of gangrene. It can hardly be, that the peritoneal surface adjacent to the hernia is as healthy and as susceptible of the adhesive inflammation as in the case of recent wound. But suppose the sphacelus to have taken place, and the living parts to be in perfect health, will they be more advantageously situated by an artificial apposition than if left to cast off at the wound? The mere apposition of two portions of unadhering intestine by a single ligature is a practice fraught with imminent danger. The partial apposition, by stitches, by which

an opening is left for the fæces, frustrates both modes of union. At the best event, the practice is a supererogation. We destroy the neat contrivances of nature to substitute our own clumsy ones. The difficulty and tediousness of the operation are sufficient to constitute a valid objection, if they are not compensated by a decided superiority of result. No more powerful argument needs to be urged against any practice than that it is useless. If at the same time it involves greater risk than another, it cannot on any principle be justified.

In incised wounds I have recommended the employment of the suture; and the reasons upon which this recommendation is founded, lead me to reject it in sphacelated hernia. In the case of wound, the system has suffered no previous disturbance; the parts are healthy and unembarrassed, and in a state to assume any disposition that may be given to them. This artificial union renders the in-

flammation local; it is accomplished with the greatest expedition, and most completely restores the cylinder. In a mortified hernia on the contrary, the constitutional strength is greatly depressed, and unable to support any vigorous action. By the morbid change which the affected part has undergone, it is prepared for a gradual process of restoration; which is effected with the smallest risk, because it produces the least disturbance, and requires the least effort.

There are two states of mortified intestine which I think require to be distinguished. The first is that in which the gut has opened and let out the matters; the second, that in which no breach has been formed. These states have usually been confounded, or at least the difference has not led to any practical distinction.

It appears to me that the art of the surgeon has been under-rated by those writers who consider the credit of the cure due solely

to Nature, in either of these cases. In many of the instances to which they refer in support of this opinion, the life of the patient was rescued from imminent peril by the timely interference of the surgeon, and by that alone. To consider the former of these states—is it nothing to afford a free outlet to the accumulated matters, which are pent up within the sac, or burrowing in the cellular substance? So much has the fact been misrepresented, that the instances in which Nature has effected a cure without the aid of art, are extremely rare; and the service of laying open the sac, which has been considered so trifling and insignificant as to have been lost sight of altogether, is precisely that signal service to which the patient owes his life: for we have seen that it is not the dilatation of the stricture, nor the return of the intestine previous to mortification, which affords relief to the patient, and arrests those symptoms which

indicate his danger. It is the removal of the obstruction, and unloading the distended bowels; as is most strikingly proved in a case related by Mr. Pott*, of a middle-aged man, whose rupture was in the last stage of strangulation. The integuments made as bad an appearance as possible, being “sunk, flaccid, and completely mortified:” the man was so materially ill, that Mr. Pott did not suppose he could receive any benefit from the art of surgery. For these reasons he was averse to an operation; but, overcome by the importunity of the patient’s wife, he divided the parts. Three inches of intestine appeared “sunk, empty, (having burst) and as black as a coal.” The operation was limited to the division of the scrotum and sac, and the “rotten intestine” was left lying on the outside of the ring; the operator “concluding that a very short space of time would

* Works, Vol. III. Case 21, p. 319.

determine the poor man's fate, and that not favourably." He was however mistaken. The mortified parts cast off, and the man voided his fæces through the wound for some time; but that discharge soon ceased, "and within the space of a month," says Mr. Pott, "I saw him in very good health, discharging all his fæces *per anum*, and having only a small, clean, and healing sore, where his wound had been." An acute observation follows: "How the fæces passed from the ileum to the colon, after the mortified parts were thrown off, I am, considering the size of the portion of gut, really at a loss to account for; but very sure I am, that if the advice given by all writers in these cases, to cut off the piece of mortified intestine, and fasten the sound part to the upper part of the wound, had been followed, the man would have passed the remainder of his life in a much more unpleasant manner."

The case now related, remarkable as it

is, has many parallels *. The symptoms of the disease are very imperfectly relieved by the oozing of the matters into the sac or cellular membrane; but the discharge which follows a free incision of the teguments and sac affords all the relief of which the patient's state admits. Mr. Pott's operation was most judicious. The desperate condition of his patient held out no prospect of relief from the efforts of the constitution; and if he had attempted more than simply to afford relief, it is highly probable he would have failed of this. We shall hereafter see that his hint at the probable consequence of an artificial anus, if he had adopted the received practice, which on another occasion he had himself advised, was not without good reason.

The other state of mortified intestine to which I have adverted, viz. that in which

* The interesting cases which Petit met with by chance upon his journies, were in a state very similar, and relieved by the same simple treatment.—*Traité des Maladies Chirurg.* Tom. II. pp. 317—319.

the spoiled gut is unopened, is by no means unfrequent. But it is remarkable that among the cases of recovery on record, the symptoms of gangrene being present, I have not met with one in which the unopened intestine was left to Nature. To leave such a case to Nature would indeed be very inconsistent with the results of experience, since the mere exposure of the part would not effect the object so often stated to be essential to the recovery of the patient. Louis comes to the following conclusion—"La parallele des différentes observations que nous avons rapportées, prouve de la maniere la plus convainçante, que tous les symptômes qui dépendent de l'étranglement de l'intestin, cessent dès que les matieres n'y sont plus retenues, *quelque soit le lieu par où la liberté de leur cours s'établisse* *." The examples of recovery on record, in which the sphacelated bowel has been opened by the knife,

* Lib. cit. p. 178. See Cases by Amyand, Phil. Trans. Vol. XXXIX. Obs. 2 and 4.

fully confirm this important inference. They are unhappily fewer than they might have been, if the sterling experience of such men as Petit and Gooch had prevailed over the flimsy conceits of Ramdohr and Ritsch.

CASE I.

PETIT, having exposed the intestine in a scrotal hernia, which had been strangulated nine days, discovered it to be ileon, in a state of gangrene, but without an opening. For a moment he deliberated on the part he should act, and then made an incision one inch in length, in the middle of the mortified intestine; whereupon a most abundant discharge ensued, to the great relief of the patient. Here his operation finished. The part was lightly covered by fine linen, moistened with an emollient decoction. At the first dressing, five hours from the operation, very little matter had been discharged, owing to the free evacuation lately obtained. The patient was in a very fa-

vourable state, and had passed a quiet night. Some spoonfuls of jelly were given him, and directed to be taken every hour. Next day, the line of separation between the dead and living parts was marked out, and Petit removed a large portion of the former. On the fourth, the process of separation was in part established. On the fifth, one of the pieces of dead intestine came away; and on the sixth, the other. Two days afterwards the epiploon sloughed. Then the wound became florid, and granulations sprung up, which seemed continuous with those of the muscles and teguments. The local treatment was confined to frequent cleansing of the wound, and the application of wet cloths; and as the patient was a good deal reduced by his regimen, the yolk of an egg was added to his jelly; and after the fifteenth day, two eggs, and a little more jelly were allowed. This sensibly increased the consistence of the discharge; but his emaciation and weakness indicated the necessity of sup-

porting him. As no passage had been obtained *per anum*, injections were cautiously administered, which brought away some hard scybalous matters. The injections were persisted in daily; and at length a quantity of bile appeared mixed with the excrement. This was a favourable omen. The wound presented less fæculent discharge, and the glysters evidently facilitated the evacuation of the bowels *per anum*. On the thirteenth day the fæces resumed their proper channel, and the wound closed a few days after *.

CASE II.

GOOCH was called to a woman of sixty with a mortified hernia. “ The teguments were much inflamed and vesicated, with livid spots here and there interspersed. The abdomen was greatly inflated, tense and painful; she vomited excrements, could bear nothing in her stomach, and had the hiccup, with a weak, quick, and intermitting

* *Traité des Malad. Chirurg.* p. 299.

pulse." He made an incision between two and three inches long, through which there was an immediate discharge of many pints of black excrementitious fluid, such as she had vomited for several days ; upon which discharge the abdomen subsided, and she found instant relief. The parts and the abdomen severally were fomented and poulticed, and for some time only a liquid diet taken often and in small quantities. She did not vomit after the operation, and her symptoms were favourable. A few days after, by indiscretion in diet, she brought on inflammation, which required bleeding thrice in twenty-four hours, and other active measures to check the fever.—“ The fæces began to be evacuated by the anus on the third day after the opening; and they passed both ways till the beginning of March, which was about ten weeks.” The wound healed soon afterwards; and the woman lived, and enjoyed good health till near eighty years of age*.

* Works, Vol. II. p. 197.

CASES III. AND IV.

“ I was lately concerned,” says the same writer, “ for an elderly man, who had a bubonocoele inadvertently opened for an abscess, and who, by such kind of treatment as advised in the preceding case, was perfectly cured. And many years ago, I was an eye witness to such a happy event, or accidental cure, in an old woman who had a femoral hernia incautiously opened, just beneath Poupart’s ligament *.”

A respectable practitioner in Norfolk, whose name I am not at liberty to mention, adopted the practice of opening the mortified intestine with similar success. In another case, in which the part was left unopened, the patient fell a victim to the disease.

In an appendix to the second edition of Mr. Hey’s “ Practical Observations,” Mr. Cooper has published a valuable case, ex-

* Works, Vol. II. p. 197.

hibiting the advantages of this practice. I was present at the operation, and attended closely to the progress of the cure, in which I felt more than common interest, as it put to the test opinions which I had already formed, and had elsewhere suggested.

CASE V.

A female, æt. 34, three months advanced in pregnancy, was the subject of strangulated crural hernia. The strangulation had existed four days ; and she was reduced to that state which immediately precedes the symptoms of dissolution, when the operation was performed in St. Thomas's Hospital; 17th May, 1808. The mortified gut being exposed, a free opening was made into it, and a plentiful and most offensive evacuation ensued. In two hours her pulse had risen from 48 to 70 ; her sickness had ceased, and she no longer complained of pain at the scrobiculus cordis. At 8 A. M. her pulse was 100.

and she had a considerable fæculent discharge from the wound.

Second day. A return of the symptoms of pain, vomiting, and hiccough, with eructation and irregular pulse.

Third day. Pulse 100. Vomiting had subsided.

Fourth day. Pulse irregular, but a natural countenance—no sickness—had slept five hours in the night—free discharge from the wound.

Fifth day. As yesterday. Nutritive diet.

Seventh day. Slough of the intestine had separated.

Ninth day. A discharge of hardened fæces *per anum*.

Eleventh day. A second natural evacuation—pulse 70, and regular. From this time she had stools once in three days or oftener. The discharge from the wound still continued free, and was sometimes profuse. On the 26th of June the wound had so considerably diminished, that a

truss was applied, the pressure of which she was however unable to bear. A very slight fæculent discharge was still occasionally observed from the wound; but the fæces generally took their natural course. She was discharged in less than two months. In three weeks from her dismissal, the wound had completely healed. I am enabled from recent inquiry to subjoin the following account of this woman's health. She has twice miscaried since her delivery of a dead child, with which she was pregnant at the time of the operation. She now has a fine child, five months old. She has discontinued wearing her truss for a year past, and has a reducible hernia at the site of the cicatrix. This has remained firm, but is somewhat tender. Her bowels are generally costive, but not more so than formerly. She is occasionally subject to cholicky pain and flatulency, during which the rupture feels tense. These are accompanied with a sensation of great weakness,

and tremblings, which symptoms are constantly relieved by alvine evacuations. Her appetite is good ; her appearance, which is naturally delicate, not unhealthy, and her spirits chearful. She is actively employed in the maintenance of a large family.

The case which follows promised an event as favourable as that last related. It occurred in the public practice of the same distinguished surgeon. For the minute and accurate detail with which I am enabled to present the reader, my thanks are due to Dr. Gillichan, of Dundalk, who had the care of the patient, and attended her with very commendable diligence.

CASE VI.

Elizabeth Aston, aged 56, was admitted into Guy's Hospital, at seven o'clock on the evening of Monday, July 15, labouring under symptoms of strangulated crural hernia.

The swelling, situated in the left groin,

and equal in size to a large orange, was painful ; but there was no discoloration of the integument. Pulse weak and rather full—belly costive, not having had a stool since Saturday preceding—retching and vomiting incessant—countenance very anxious. She had been for eight years the subject of a femoral hernia, which was never completely reducible, a tumor the size of a walnut always remaining. The fresh descent was occasioned by an over-exertion. But few attempts were made by the taxis, owing to the great sensibility of the parts, which seemed to increase during a stay of twenty-five minutes in a warm bath ; and after the administration of a tobacco enema, at twenty minutes past eleven on the same evening, the following operation was performed.

The common integuments were divided by an incision in the form of a T reversed, by which the more immediate coverings of the sac were exposed ; they were found thickened and tense. Upon cautiously di-

viding them, the hernial sac was brought into view; an opening being made into it, it discharged a small quantity of fluid, and putrid effluvia likewise escaped. The opening being enlarged shewed a considerable portion of omentum, thickened, converted into a fatty mass, and quite putrid; its adhesions were extensive; and upon removing with the knife a large quantity of it, which was done without the least hemorrhage, there was discovered a portion of the small intestine, which appeared to be the whole cylinder of the gut, of a very dark colour. At its lowest part it was covered with an ash-coloured slough, from whence issued some air, and an inconsiderable quantity of a bloody serum; the gut tore upon slight application of the finger; a large opening was made in it, and the stricture was dilated freely, in a direction towards the navel. The integuments were brought together at the angles by suture, and an opening was left opposite the mortified intestine; the

patient was now placed in bed, a poultice applied, and she took a small quantity of wine.

16th. 7 A. M. Slept about four hours—feels much relieved—countenance cheerful—pulse 102, the same as before the operation—complains of some pain at the scrobiculus cordis—vomiting has ceased—flatus only has passed from the wound—abdomen directed to be fomented.—1 P. M. At 10 o'clock, she had an attack of vomiting—matters bilious—belly tender when touched—no fæculent discharge from the wound—pulse 96—a glyster, which was given about two hours ago, after being retained for a few minutes, came away unchanged. 9 P. M. Has had several copious evacuations from the wound, during the evening—no vomiting since two o'clock—belly less painful—pulse 102, small and weak—slept upwards of two hours, and upon the whole is much better than she was in the morning

—has taken some porter, which she prefers to wine.

17th. 7 A.M. Slept several hours during the night—bilious discharge very copious—no return of vomiting—belly free from pain—pulse 96, rather full—wound looks well, being but slightly inflamed—ordered milk for breakfast. 9 P. M. Is quite easy—discharge very free—portions of curdled milk were observed in the matter which came away about three hours after—during the evening, air has frequently been passed by the anus—wound and surrounding integuments very much swollen and inflamed—pulse 84—ate some lamb chop for dinner, which she relished.

18th. Slept well during the night—eats her food with appetite, and feels refreshed after it—pulse quick and small—discharge copious—considerable excoriation of the skin surrounding the wound.

20th. Is much as when last reported—

wound not quite so painful—discharge rather more frequent—pulse 90, and full.

22d. Has rested well—eats her meals with appetite—the liquids which she takes have passed off much sooner for the last day or two, than they did before. In ten minutes, milk and wine, which have been swallowed, are observed at the wound ; sometimes half an hour elapses. It was at first three hours before any thing came away : last night and this morning, after taking some wine, she was severely griped ; and immediately afterwards, there was a very copious evacuation from the groin. At ten o'clock this morning, the whole of the mortified portion of intestine together with a quantity of omentum protruded beyond the margin of the wound, during a profuse discharge. She appears very weak and languid—pulse 72, and feeble—slept some hours during the night.

23d. 1 P.M. Rested well last night—feels very weak—has an appetite for nourish-

ment—liquids do not pass off so quickly—says that some fæculent matter in a fluid form passed the natural way, together with flatus, this morning. About ten o'clock, upon removing the dressing from the wound, the mortified portions of intestine and omentum came away; of the latter, small pieces have repeatedly separated—wound much inflamed—healthy granulations are filling up the cavity—pulse 72, rather weak. Capiat Tinct. Opii g^{tt} v. 4^{tâ} quâque horâ. 10 P.M. Has taken some gruel with a little wine in it, from which she seems much refreshed—has just had an evacuation of a curd-like matter, having taken some milk about three hours ago.

24th. 10 A.M. Slept little—pulse 90, and feeble—flatus has frequently passed *per anum*, and as she says, liquid fæces—the draw-sheet appears soiled—there had been no discharge from the wound since twelve o'clock last night until six this morning,

when there was a very copious evacuation. The parts surrounding the wound are much excoriated. 9 P. M. Great soreness about the wound—discharge from the artificial anus frequent, but not copious—pulse 90, very weak—slept some hours during the day—appetite failing.

25th. 9 A. M. Slept well during the night—complains of weakness—pulse 90, and small—discharge not so frequent or copious—excoriated surface not so painful—a quantity of sponge, having been applied around the edges of the wound, has absorbed the acrid bile, and prevented its running over the sides of the abdomen, and down the thighs—granulations looking very healthy, and are nearly level with the surface—is eating her breakfast with some degree of appetite. 9 P. M. Pulse more full and strong—complains greatly of the excoriation—has eat her meals with appetite—a bilious fluid flows very profusely from the

artificial anus. Augeatur dosis tinct. opii ad g^{tt} viij. et applicetur partibus degluptis aqua calcis cum lacte.

26th. Slept little during the night—pulse small and weak—discharge from the artificial anus not so acrid nor frequent—took some calf's-foot jelly with but little appetite; it was retained about an hour and half—excoriated surface much better—for several days has felt a strong inclination for a stool the natural way—much flatus still passes.

27th. 9 A.M. Passed a sleepless night—about one o'clock this morning, vomited a small quantity of bilious matter, and again a few minutes ago—has had hiccough for some hours—appetite quite gone—pulse 90, small and weak—discharge very copious and acrid. 9 P.M. Refuses all sustenance, except a little wine—has vomited several times a dark coloured fluid in small quantity—had a short sleep during the day—

complains greatly of spasms in the calves of her legs.

28th. 9 A. M. Vomiting still continues—slept some hours during the night—discharge black, not so copious, or irritating—excoriations better—pulse about 92, and weak—has taken no nourishment. *Omittatur tinctura opii.* 9 P. M. Retching and vomiting continue—pulse more full and strong than it has been—discharge from the artificial anus very dark coloured—wine and porter rejected soon after taken into the stomach—has retained only a small quantity of beef tea—complains very much of a severe sharp pain in the right hypochondrium, at the scrobiculus cordis, and shooting up to the right shoulder. *Applicetur lateri dolenti vesicatorium; capiat extract. opii gr. i^m, secundâ quâque horâ.*

29th. 9 A. M. Has passed the night in great agony, and entirely without sleep—every thing taken into the stomach immediately rejected by vomiting—complains

very much of pain in the right hypochondrium—great anxiety of countenance—pulse 90, full and strong—the matter discharged from the artificial anus dark coloured and scanty—excoriated surface appears better. 5 P. M. Continued to suffer till half past three o'clock, complaining still of the pain in the right hypochondrium and shoulder: for about half an hour she appeared free from pain; and a few minutes after four she died.

Inspection on the following day.

The peritoneum was universally affected by an inflammation of the suppurative kind. The wound was situated in the superior part of the hernia; the tract of bowel between the stomach and artificial anus was of natural size; below it, the gut was contracted in diameter. The extremities of the gut were opposed at an angle, and firmly secured in their situations by extensive adhesions to the

parietal peritoneum. The omentum likewise adhered to them. Owing to the quantity of adeps lying beneath the skin, the depth of the intestinal opening from the surface was very considerable. Mr. Cooper kindly permitted me to have a sketch made of the parts, which are exhibited in two views *.

That the termination of this case was contrary to that which those who saw the patient could anticipate, may be gleaned from the report of the symptoms, and the survival of the patient for a period of fourteen days. It is impossible to say what was the origin of the peritoneal inflammation which proved fatal; but that it had not existed at the time of the operation, or rather that it had very recently supervened, was evident to those who witnessed the patient's freedom from suffering of every kind; her natural countenance, refreshing sleep, and

* See Plate VI.

relish of food for a week subsequent to the operation. The symptoms of defective nutrition however were so far established before those of inflammation had appeared, as to threaten the slower but scarcely less certain destruction of the patient.

I shall now shortly particularize the treatment which I have ventured to recommend.

1. A strangulated intestine must be in one of two states, viz. recoverable or irrecoverable. The former includes the inflamed: the latter the mortified state. Where disorganization has not commenced, or having commenced, is superficial or circumscribed, the bowel may be returned under the restrictions before advised. Fomentations and glysters must be had recourse to immediately, and a mild purgative be exhibited, in the least offensive form, as soon as the irritability of the stomach has subsided sufficiently to allow of its being retained, and it should be

repeated at short intervals, until bilious evacuations are obtained *.

2. Where the gangrene is general or complete, and the matters are discharged through an opening or openings in the gut, a free incision of the sac is all that appears to be required. If the spoiled gut is extensive, the surgeon may use his own judgment concerning the removal of the sloughs, for the sake of cleanliness.

3. Where, under the same state of disorganization, the gut has not burst, and the process of sloughing has not commenced, an opening should be made near to the stricture sufficient to admit of the discharge of the matters. If the stricture should still be sufficient to retain the matters, which will seldom be the case, a moderate dilatation

* Rougemont, in his notes upon Richter, quotes a case from the Acts of the Academy of Sienna, in which the ileon, in an inguinal hernia, was returned with a gangrenous spot. The wound was sewn up. The man recovered so expeditiously, that on the eleventh day he was walking about the Hospital, and on the fifteenth quitted it, perfectly restored.

of it will be required. If the discharge is scanty, and the symptoms are imperfectly relieved, a gentle laxative may be exhibited. An enema should be administered, without changing the position of the patient, night and morning. The dressings should be of fine absorbent linen, and so frequently renewed as to prevent the accumulation of bile or fæcal fluid in the wound ; and every precaution should be taken to preserve cleanliness, and prevent the overflowing of the bile and consequent excoriation of the skin. Bile appears essentially to promote a healthy granulation. Strong soups and animal jellies, and every variety of nutriment in a condensed but easily assimilable form, should compose the patient's diet. Of the propriety of exhibiting cordial, or tonic, or astringent medicines, I am very doubtful. The augmentation in solidity and quantity of food should be gradual ; and especial care should be taken to prevent obstruction to the mat-

ters, when the wound inclines to healing, and the discharge becomes sensibly diminished. A gentle laxative, such as oil or manna, might probably be given at this time with advantage*. This, and doubtless many other points, must be determined by further observation.

4. Where the rupture is small, and the symptoms indicate the presence of gangrene, unless the patient is, strictly speaking, *in articulo mortis*, I would open the rupture by a free incision, treating it as an abscess; so that the fæcal matter should follow the knife. Many have been the cases in which patients have been left to die, from a belief that the case was beyond recovery, and would bring a discredit upon surgery; and many too have been the cases in which ignorance of the disease has led to its proper treatment. Of the former I am sure I have witnessed instances, in which

* Vide Obs. par Chastanet, Mem. de l'Acad. Tom. III. p. 160.

however the surgeon, acting from his best judgment, was of course free from all imputation. Of the latter, Mr. Wardrop favored me with the following example.

CASE.

A middle-aged man had a swelling in the left groin, covering the crural ring. From the distinct sense of fluctuation which the tumor communicated, it was punctured; when in place of a puriform fluid, as was expected, a thin, brown coloured matter was discharged. This circumstance led to a suspicion that the disease was a femoral hernia. The history of the tumor, its formation, situation, and accompanying symptoms, corroborated the opinion, and made it probable, the patient's bowels remaining unobstructed, that only a portion of the canal of the intestine had passed through the crural ring. The symptoms of general fever, pain, and tension abated after the tumor was

punctured, and the wound continued to discharge the same kind of matter as when first opened. The swelling at length subsided, and in a few weeks the wound shut up, leaving the patient in perfect health.

It is probable that most of these are cases of partial strangulation *. We have shewn that they are not on that account the less worthy of attention. Where the symptoms are more urgent, the relief afforded by this simple treatment, which avoids the formalities and the lengthened severity of the operation, is visible in the countenance of the patient.

I shall conclude with a relation of some experiments to ascertain the natural process of union after sphacelus from stricture of the intestine, and a remark or two on the artificial anus as a consequence of hernia.

* See M. Pipelet's observations on this subject in the *Mem. de l'Acad.* Tom. IV. pa. 170.

EXPERIMENT U.

A portion of the small intestine of a bitch was drawn through a small aperture by incision of the abdominal parietes. A waxed thread was then tied around the knuckle of the gut, and the wound sewed up closely with the remainder of the thread.—Second day. She refused food, and avoided all motion ; the strangulated gut was to appearance sphacelated ; and I cut away the threads, so as to release it from stricture. Some hours afterwards it was distended with flatus, which, by gentle pressure, passed into the canal.—Third day. The gut burst on touching it, and a dark coloured and very fetid fluid was freely poured out over the abdomen. I cut off the slough without disturbing the sound parts. The animal appeared free from pain, but refused food.—Fourth day. A complete artificial anus was established ; and the surrounding integument was irritated and inflamed by the discharge.—Fifth day. The animal appeared sunk, and

low ; from her appearance, I concluded that she was not nourished. A slimy dark coloured discharge continued to pass from the artificial anus. On the sixth day she died.

Examination.—Peritoneum natural—the cylindrical ends of the gut appeared clean and in opposition, but external to the peritoneum ; the intestine above the opening contained a little of the same matter as that discharged by the artificial anus.

EXPERIMENT W.

A knuckle of small intestine was drawn through a muscular aperture, and the skin sewed over it. The aperture was not however sufficiently small to strangulate the gut, as was intended : it inflamed, adhered to the peritoneal margin, and became an irreducible hernia, from which the animal appeared to suffer no inconvenience. After some days it was laid open by incision, as in an operation for hernia. The integument adhered to it, and it adhered in its

whole circumference to the peritoneal wound. The adhesions external to the peritoneum were detached, and a ligature was carried round it, as near as was practicable to the point where it quitted the abdomen. The gut sloughed so speedily, that the matters came away very freely on the second day. The animal took some milk, and seemed doing well.—Third day. The sloughs had fallen, and the extremities of the gut were visible. A yellowish fluid was evacuated freely at the artificial anus; the dog took but little nourishment, and appeared weak and low.—Fourth day. He seemed to be sinking, but was revived by eating a little raw meat. Free fæcal discharge.—Fifth day. He died, much emaciated and apparently famished.

Examination.—The ileon had been the subject of experiment. The wound was extensive and sloughy. The ends of the intestine presented clean and circular edges, and were opposed, but at some distance asunder.

There was no trace of peritoneal inflammation. This experiment was more than once repeated, but with no better success. The ligature being external to the peritoneum, the ends of the gut were uncovered, and a permanent artificial anus was inevitable. From the time at which the artificial anus was established, which was seldom two days from the application of the ligature, the animal's strength, and the little inclination for food which it shewed before the opening, gradually failed; and he died exhausted, as above described.


In not one of these experiments was any symptom of suffering expressed, nor was the faintest mark of inflammatory affection discovered within the abdomen.

As it appeared that the separation of the slough effected after a stricture thus applied uniformly induced an artificial anus, and that the animal was unable to support the preternatural discharge, it was desirable to ascertain if such an alteration in the circumstances as would prevent this consequence,

would admit of the process of union. This view suggested

EXPERIMENT X.

Having made an opening into the abdomen of a dog, and brought out a fold of ileon, it was strangulated by a ligature applied a little above the angle. The strangulated piece was then cut off below it, and the cut extremities connected by the ligature were carefully put back into the belly. The wound was sewed up, and the animal did not appear to suffer materially.—Second day. He was sick, vomited bile, but drank water and a little milk.—Third day. Continued much the same.—Fourth day. Passed a solid stool, and from this time recovered his looks and spirits. After a month, having perfectly recovered, he was shot.

Examination.—The external wound was healed. The abdomen presented no appearance of disease, and but few adhesions of the peritoneum. The ileon lay upon the vertebræ in this position: 

At the internal angle the sides adhered to each other. The opposite was closed by adhesions to the omentum and neighbouring intestine. Upon carefully laying open the tube, it appeared that the ligature and the ends of the gut had been discharged through the canal. At one point the line of union was scarcely completed; and there appeared a little cyst, like an abscess, communicating with the tube, in which the tied ends of the gut had been lodged previously to their being voided. Fig. 1. Plate VII. is a drawing of this preparation; and it will be evident upon comparison that its appearance so very exactly corresponds with Fig. 2, Plate III. (the union after the ligature of the single tube) as completely to establish the identity of the processes.

It appeared from this experiment, that where a fold was included in a stricture, the canal was susceptible of restoration, if left in contiguity with the peritoneal surface. The operation of the

stricture upon the coats of the bowel was the same; and the mode of union, judging from the appearances, precisely the same as in Experiment O. The greater angularity observed at the point of union, and the little circumscribed cyst containing the slough and ligature, which was necessary to their expulsion, form no exception to this remark. This last appearance was so far obliterated as but faintly to indicate what had taken place. In another month it would not in all probability have been discernible. The discharge of the slough through the intestine preserved the animal from the drain of an artificial anus, so that his appetite and strength could scarcely be said to fail him. Since it was ascertained that by avoiding the artificial anus, the union consequent upon the stricture of a fold of intestine was both speedy and secure, it seemed probable that the knuckle might be discharged together with the ligature through the canal, and that thus an internal hernia, as well as

an intussusception, might cure itself*. It was accordingly attempted as follows.

EXPERIMENT Y.

An opening being made into the abdomen of a fat healthy dog, a ligature was tied around a knuckle of intestine: the ends of the ligature were cut off, and the part returned.—Second day. He appeared sick and suffering.—Third day. He died.

Examination.—A profusion of serum had been shed into the abdomen, but no where lymph. The muscular and visceral peritoneum exhibited the appearance of a very

* The cure of the intussusception was demonstrated by Experiment O. What an intussusception is in relation to the single tube, the hernia is to the fold. Numerous instances of the slough and discharge of portions of the gut *per anum*, are upon record. Of these, few if any have been examined where the recovery had been complete. For authentic cases of this description the reader may consult Hevin's Memoir on Gastrotomy, in the fourth volume of the French Academy—Duncan's Comment. vol. 9, and Annals, vol. 6—Phys. and Liter. Essays, vol. 2—and the Memoirs of a Society for promoting Medical and Chirurgical Knowledge, vol. 2. &c. &c.

acute diffused inflammation. The strangulated gut lay coiled up in the omentum, so as to be hidden from the view. The villous coat of the intestines was extensively inflamed above and below the strangulation. The parts were removed; and a longitudinal section of them exhibited the very interesting appearances delineated in Fig. 2, Plate VII. It will be seen by reference, that the omentum had formed a sac, enveloping the dead piece and the ligature, and had thus speedily accomplished the continuity of the canal. The strangulated portion was perfectly rotten, and nearly detached. The intestines were agglutinated to one another and the surrounding omentum.

In this experiment, notwithstanding the destructive vehemence and extent of the inflammation, the effort at restoration was most strikingly evinced. As the appearance carried conviction to my mind that it might be accomplished,

EXPERIMENT Z,

was a repetition of it, upon an animal in less vigorous condition.—Second day. The dog was often very sick, and in the evening he died.

Examination. Appearances of high inflammation accompanied with a fæculent effusion. The matters had issued through a small opening in the cyst enclosing the strangulated piece, which was at every other part walled in by omentum, as in the last experiment. Through the opening above mentioned worms had passed into the belly.

As I foresaw no adequate advantage to be derived from prosecuting so painful an investigation, I could not consent to repeat these experiments; but from their results I feel fully persuaded that Nature is capable of overcoming such an obstacle to her functions, when presenting itself in the form of a casualty, unaccompanied by the injury

which is inseparable from such an operation*. I have heard of cases in which the symptoms of mortification have unaccountably passed off, and the patient has recovered by some natural operation. The following original instance of this extraordinary fact is communicated to me by the gentleman who was the subject of it; and I may add from an intimate knowledge of him, that there is no man living, in the authenticity of whose statements I place more unqualified confidence.

CASE.

“ I will relate my case as faithfully as I can from recollection, reminding you, as an

* It is by no means improbable that of the cases in which portions of disorganised bowel have been voided *per anum*, some have been internal herniæ, arising from malposition, or laceration of the mesentery or omentum, or the production of such ligamentous bands as we sometimes find crossing old hernial sacs. In the plate illustrating the observation of Moscati (Mem. de l'Acad. tom. 3, p. 468) the situation of two folds strictured by a ligamentous band, is well exhibited. If only the smaller fold had been included in the stricture, it is very easy, from the result of Experiment Y, to conceive that it might have sloughed into the canal. — See also Plate 7 in Dr. Monro, jun.'s “ Observations on Crural Hernia,” and Plate 17 in Mr. Cooper's work on the same subject.

apology for any want of precision, that when it occurred, my views were not at all directed to physic. By the way, I may mention, that that illness and its circumstances recurring frequently to my mind in the course of nearly a year of very bad health which succeeded it, contributed not a little to make me abandon a profession which the state of my health seemed to render impracticable, and had some share in inspiring me with the desire of embracing the medical profession. When about nine years old, in consequence of hard straining to lift heavy weights, I felt a small lump in my groin. I mentioned it to my father. A physician at S—— was consulted, who advised bathing the part, morning and evening, with a decoction of oak bark : nothing more was done. I do not remember whether this tumor, which was not large, had the character of a herniary tumor. In 17.. I went to a school about four miles from B——, and for a year or two I saw nothing of this tumor, till one day, after

fighting with another boy, when I complained of it to the master, who consulted the housekeeper, who consulted an old woman in the village, reckoned skilful in curing ruptures. She made me a cotton stuff bandage, with a little soft pad to rest upon the spot where the swelling had been. It did not reappear. The bandage was soon worn out, and I thought no more of my rupture, until the month of May, (six years from the former date.) I was now eighteen years old, in full health; could take violent exercise in running, leaping, football, cricket, and wrestling, without the slightest inconvenience. About the middle of the month above mentioned, I had one day been carrying for a wager a boy of my own size, and I was within an inch of my present size, for a considerable space, and with all the speed I could make; when in an instant I felt as if something gave way (I am speaking from the impression at the time), and on applying my hand to my groin and scrotum, I found the whole much

swelled and excessively distended. I am sure my scrotum could not be smaller than a cricket ball. I laid down on my back, as I had formerly been taught, but vainly tried to reduce the tumor. I felt great pain in my belly. I went with the other boys into the school, but had not been there long before the pain in my belly obliged me to leave it. I was soon after very sick, and vomited a large quantity of bilious matter; and the vomiting recurred frequently. My belly was very hard; but I do not remember its being tender to the touch. The house-keeper, whose medical skill had formerly been employed upon me, sent me some spirits and water, which acted as an emetic in increasing the vomiting; and I felt so much relief every time I had vomited, that I often after called for the brandy and water; but it was denied me. The day after I was taken ill, Mr. G. was sent for; he bled me, and attempted, but in vain, to reduce the tumor. I was perpetually trying the same myself. I took an infusion of senna

that he sent me. You may be sure I did not retain it long on my stomach ; and you may guess how much good it did me. In the mean time, the pain I suffered was horrible : I never think of it without shuddering ; and, as you may suppose, I sympathize with those who suffer from this dreadful malady. Whether it was on the third or fourth day that Dr. F. was called in, I do not remember ; but I remember his going with Mr. G. to the garden, to collect plants, which were boiled, and made into a warm fomentation, and applied to the tumor. They were soothing, and I used them diligently. I need not tell you how little I knew the nature of calomel when I overheard Dr. F. say it was to be administered to me ; and its name made an impression on me ; for, from his manner, I suspected it was to be what the vulgar call a kill or cure medicine. What the dose was, I have never known ; it was certainly conceived to be very strong ; but I vomited so frequently, that much, if not the whole of

it, must have been rejected. I was now in constant pain, got no sleep, tossed about in my bed, and vomited frequently most offensive matter, in a quantity which seemed to me to exceed what I took in. However, I was miserably thirsty: this I remember, because I was not allowed to allay my thirst. Drinking was grateful; and I felt relieved after vomiting. I had overheard some talk about an operation. I imagined it to consist in making an opening into my belly, and untying some knot of the guts; and in the agonies of unceasing pain, I intreated they would rip me up, or do any thing to cure me. I do not know what replies were made; but nothing was done, except that Dr. F. seated me on a chair with my feet on the hearth-stone, and dashed cold water over my legs and scrotum. About the middle of the sixth day, my pain began to diminish, and my strength to leave me. I felt as if I had not long to live. I received the sacrament, and shook hands

with the most intimate of my school-fellows. By the time all this was over, it was dusk ; my pain had entirely left me ; I thought death at hand ; and I remember I had no fears of it, and no regret, except at the thoughts of my poor father's grief. I remember this feeling, and expressing it. I should think it was about 8 P. M. when Dr. F. came, bringing with him Mr. R. of A. Mr. R. brought with him an apparatus for injecting tobacco smoke *per anum*. It was not used ; and I have since learned that it was their joint opinion that I had but a few hours to live ; and preparations were actually made to dispose of my body, i. e. a person sent for to lay me out. Mr. R. examined my scrotum : it was soft ; the tumor was reduced with perfect ease : I felt a desire to go to stool ; and for several hours, I had an incalculable number of stools, thin, of the most horrible stench, and copious. They came away at times involuntarily. I was fed with warm brandy and water. I had not strength to raise a spoon,

I might say my hand to my mouth. After staying some time, two of the Doctors went away, saying I should be dead before morning; and about break of day, Mr. G. left me, as he thought, *in articulo mortis*. After these evacuations, I fell into a slumber, supposed to be my last, and awoke, next morning, free from uneasiness, and asked for some food, An express was sent to announce my resurrection to the Doctors. In about six weeks, I was able to leave school. I need not tell you I have ever since worn a truss, and not a truss made by the old woman at ——. Though I have since taken violent exercise in hot weather, and have not been so prudent as I should recommend any man, who had had such a lesson, to be, I have had no return of the disease.”

The interest which I felt in the perusal of this unaffected narrative induced me to lay it, without abridgment, before the reader. The explanation of it which occurs to my

mind as most probable, is that which renders its introduction appropriate in this place, viz. the death of the intestine included in the hernia, and its separation into the canal. This opinion however is insusceptible of proof; and the reader, after duly weighing the circumstances, must decide for himself.

In the commencement of the experiments now related, for the sake of a closer analogy with hernia, I attempted to produce a natural stricture which should occasion a sphacelus of the gut. Having repeatedly failed of this object, I employed the artificial stricture of a ligature. When this was applied and retained at the wound, the whole separated externally to the peritoneum, and left the ends of the gut uncovered, and forming an incurable artificial anus. Since I could not obtain the fixed natural stricture, I again subjected the bowel to the ligature, and returned into the abdomen a portion of the strangulated fold, sufficient to retain the ligature. This injury, considerable as it was, was speedily repaired,

the parts being on all sides surrounded by a peritoneal surface. This event encouraged an idea that the knuckle would be disposed of in the same way; but the irritation occasioned by so large a portion of dead, and consequently extraneous matter, caused a diffused inflammation and death. As the effort of Nature to repair the local mischief was thus strikingly demonstrated, it appeared more than probable, that if the reduction of the strangulated piece could be avoided, and on the other hand the artificial anus be prevented, the canal would be restored. In another experiment it was contrived, though with difficulty, that the peritoneal aperture should form the stricture; and the integument was drawn over the strangulated piece. The animal recovered; but no discharge was observed at the wound, which in a fortnight was very nearly healed. Upon inspection, the gut was found fixed to the wound, greatly contracted by irregular adhesions, and the puckering of the mucous

coat. There was no fissure or mark of discontinuity upon the mucous surface, except a small ulcerated aperture which communicated with the wound. It was thus evident that the gut had been retracted into the abdomen, so as to escape the stricture. The following are practical deductions from these experiments.

1. The peritoneal surface is essential to the restoration of an intestine of which a part has been disorganized by stricture; for if the stricture is external to the peritoneum, the parts are insusceptible of union, and the artificial anus is permanent (Experiments U. W.): but if the stricture is formed by or within the sac of the peritoneum, the tube is susceptible of restoration (Experiment Y.) If the peritoneum, agreeably to the opinion of the ancients, was ruptured instead of being dilated to form a sac inclosing the hernia, it is to be questioned whether the process of union could take place so readily as it has been often known to do.

2. A complete artificial anus in the small intestine is uniformly fatal to the animals which were the subjects of these experiments, by retrenching the surface of absorption. The injury inflicted by the stricture is in this case purely local; the abdomen preserving its natural healthy aspect.

3. The stricture upon a knuckle of the intestine operates upon the same principle as the ligature of the single tube. If it is formed within the abdomen, the process is more hazardous, because a larger portion of dead matter requires to be enveloped, and consequently the adhesive inflammation must extend further, to prevent effusion. The walling in of the whole fold *, including the strictured portion, is the first step of the process; the disengagement of the dead part by ulceration, and its discharge by the canal are consentaneous with the organization of the adhesions. The villous surface presents a horizontal groove, marking the line of di-

* Plate VII. Fig. 2.

vision *. In the ordinary situation of hernia, the portions of intestine embraced by the stricture occupy a position nearly parallel. Their contiguous sides mutually adhere; in the remainder of their circumference, they adhere to the peritoneum, lining or forming the stricture. The existing adhesion of the contiguous sides, strengthened by the adhesion of the parts in contact, insures a partial continuity upon the separation of the sphacelated part. The line of separation is the line of stricture. It commences on that side of the gut which is in direct contact with the stricture. As the separation advances, the opposite adhering sides may perhaps recede somewhat, and a little enlarge the angle of union. But it is ever after an angle; and where the peritoneum is deficient, the canal is simply covered in by granulations from the cellular membrane of the parietes coalescing with those of the external or cellular surface of the peritoneum.

* Plate VII. Fig. 1.

Morand has a paper in the Memoirs of the French Academy of Sciences, in which he professes to explain the theory of intestinal union, and illustrates his theory by diagrams*. He conceives it to be necessary for the adhesion of a wounded intestine, that a fresh cut edge (“sanglante entamé”) should lie opposed to it, that thus the lips of the two may form one cicatrix. This may and often does happen as a coincidence; but it is not essential †, as I have elsewhere shewn. He likewise observes that continuous surfaces adhere under inflammation; as for example, the intestine to the mouth of the sac. He then goes on to explain with sufficient accuracy, the favourable situation which the ring or stricture gives to the parts to be united, and the advantage resulting from their adhesion. But willing to complete the description, he calls in the aid of

* Sur la reunion des deux bouts d'un Intestin, une certaine portion du canal etant detruite. 1735.

† See page 58.

the longitudinal order of fibres, to correct the angular disposition of the parts ; i. e. by their action upon the inner or contiguous side, to draw the walls of the gut away from the ring, and resist the contraction of the circular fibres. This he does, conceiving that while the extremities are fixed in an angular position, the distance of their outer or parietal edges must render their adhesion to each other impossible. All this is ingenious ; but it is not the simplicity which characterises the operations of Nature. The angular disposition is permanent ; and the “ retrecissement,” or contraction of the canal at the angle of union, the causes of which have been explained, is not to be prevented. The union cannot be direct where the whole circle is not in opposition. On the outer or parietal side, the canal must be more or less formed of parts foreign to its texture, after extensive wounds and hernia. In the former, the judicious use of the suture will restore the integrity of the canal ; and in the latter, the adventitious texture

will be of small extent, if the stricture is left undivided*. It is the free incision of the stricture, as before stated, which retards union; and favors the formation of the artificial anus. In every specimen of spontaneously united intestine, the point of union form an angle adhering so intimately to the stricture, as to render their separation impracticable. Morand states, that he had seen several such instances; and Amyand and Pipelet have recorded the fact in detail. The first of these respectable authors examined a man, who eight years before had received a gunshot in the intestines, which had given origin to an artificial anus of several months' duration. The colon was much contracted at the part where it had been shot through; and "it appeared pursed up, and inseparably knit to the ilium bone," i. e. to the peritoneum lining the ilium †. Nevertheless

* It has been shewn that a peritoneal surface is essential to the spontaneous restoration of the canal, and the capability of restoration will be in proportion to the integrity of this surface.

† Phil. Trans. Vol. XXXIX. 1736.

this man had made no complaint since his cure. Pipelet's observation is of great value, because it combines the treatment of the case with its effects, immediate and remote. The patient was a woman, 56 years old; the loop of spoiled gut was from five to six inches long; the matters passed for a considerable time by the wound, and maintained an artificial anus. Some accidental obstruction occurred; a purgative was given, which operated in the natural way; and in fifteen days the wound was healed. She lived in perfect health to the age of 82, when she died of a disease not connected with this malady. Pipelet examined the body, and has given a figure representing the union. The line of the intestine formed an acute angle, where it adhered to the peritoneum, opposite to the crural arch. The cylinder is evidently much contracted in its circumference*. Pipelet very cor-

* Mem. de l'Acad. de Chirurg. Tom. IV. p. 164.

rectly remarks upon the angular position and straightness of the tube at the point of union, as a preternatural but unavoidable condition. The intestinal was more contracted in its diameter than the ventricular piece. This is I believe generally the case, the lower portion continuing undilated during the early stage of the healing process.

When I speak of the artificial anus as a consequence of hernia, I refer to that established form of the disease which has been commonly regarded as incurable. But its relation to hernia, as a very common and lamentable consequence of that disease, is the especial object for consideration in this inquiry. It is not possible to state with certainty the circumstances to which its frequency is to be attributed; and since the disease has existed where opposite plans of treatment have been pursued, the attempt to glean this information from historical narrations would be unsatisfactory. The most experienced writers on the subject, in

many cases approve the practice of establishing the artificial discharge, believing that the circumstances offer no alternative. Where the hernia has been large and adhering, and the gangrene in proportion extensive; where, for any reason, the suture of the intestine could not conveniently be performed, the artificial anus is to be formed in the manner directed by Littre. On the other hand, if the spoiled intestine is conceived to be adjoining the stomach, it is, if possible, to be prevented by the employment of the suture. Thus we are advised to shape the operation to the circumstances of the case. Now it appears to me that this advice is calculated to do much mischief. We read of the superior discrimination required to determine in what cases the artificial anus is indispensable; and while we are admonished of the cruelty of embittering life by such a malady when it might have been prevented, are warned of the danger of destroying the patient by neglecting to provide for it. But

this danger is in truth created by the practice which these writers advocate; for the history of these cases, if it proves any thing, proves this: that the canal has been very generally restored when the artificial anus was reckoned upon as inevitable, and that where an officious solicitude had been at work to prevent it, shewing itself in an active interference with the arrangements of Nature, the case has terminated in artificial anus; so that the event, either way, has been a matter of surprise to the surgeon. The fear of doing too little or too much, applies only to the pernicious custom of dilating the stricture, displacing, amputating, and sewing the intestine; the general adoption of which practice fully accounts to my mind for the number of artificial ani which are the sequelæ of hernia*.

A most ingenious modern writer has pointed out the mechanical obstacles which

* Let the reader attentively peruse the case reported by Dr. Cheston of Gloucester, in the first part of Mr. Cooper's work. It will furnish him with matter of useful reflection on this head.

the malposition of the parts opposes to the cure of the disease. These obstacles may sometimes exist among the unfavourable circumstances of the case ; but they are most frequently set up and confirmed by the practice adopted in the operation. They are not the natural and necessary concomitants, much less the causes of the artificial anus. I have already shewn that the position of the parts of an intestine included in a stricture is favorable to their union*. Practitioners, not aware of this circumstance, have been easily reconciled to the artificial anus after hernia. They have considered the patient's chance so desperate as to render his recovery, with whatever drawback on his comfort, a cause for congratulation ; and from the loss of substance, greater or less, which the intestine has sustained, the restoration of the canal has appeared an event too improbable to be expected. Thus when Mr.

* Several of the plates in Mr. Cooper's work further illustrate this observation.

Pott found his patient, who a month before had parted with whole inches of his ileon, passing natural motions, he expressed his astonishment, as many others have done, at the restoration which must somehow have been effected. If he and his cotemporaries had been acquainted with the fact, that by the operation of the stricture the continuity of the tube was in great part regained before the loss of substance was incurred, the mystery would have been cleared up.

The power of restoration, it has been abundantly proved, is not impaired by the loss of substance, but by that of contact. Thus a mere division of the tube by a cutting instrument is irreparable, although six inches of the bowel may fade and be cast off without leaving a trace of the injury. If the breach occasioned by the retraction which ensues upon division be artificially obliterated, as by suture, it too may be repaired : a plain proof that continuity alone is essential to the process. But if the gut con-

nected by suture be in a morbid state, it will not unite; the ulceration which sets the ligature free will be more rapid, while the adhesion which preserves the parts in connection will be more slow than in healthy parts, if not wanting altogether: to say nothing of the probability of a laceration of the gut, or of the suture yielding to the pressure of accumulated matters. Under such circumstances the artificial anus will be the most fortunate issue of the case. On the other hand, if the adhesion already established by the stricture, which has provided a continuity upon the separation of the slough in one half of its circumference, be not molested by the forcible removal of the gut from its connections, there exists a facility for union which will hardly allow of the formation of an artificial anus.

From the cases which I have related, and many others that might be added, it is clearly deducible that there is a period at which the function of the lower portion of

the canal, with a little assistance of the kind before mentioned, may be restored. The natural order of events connected with recovery has been mistaken and inverted. Practitioners have closed the wound, instead of conducting the matters by purgatives and glysters into the large intestines*. Now the wound will never fail to heal when the matters recover their accustomed route; but this condition cannot be reversed. The restoration is safest when most gradual; when there is evidence of an existing sympathy between the repair of structure and the return of function. Where this consent is even imperfectly attained, we may look with confidence to the event.

Upon the whole therefore, I am disposed to consider the artificial anus following hernia, in the same light as that which is the con-

* Richter mentions an unsuccessful attempt of this kind. The lips of the wound were treated by an escharotic, and afterwards connected by suture. The wound closed, but in a few days opened afresh, and the patient had no inclination to have the experiment repeated.

sequence of wound, viz: either as the result of inattention, from ignorance of the power and means of affording relief; or of improper treatment, from incorrect notions on the subject*.

If we attentively peruse the cases on record, we shall see that where the artificial anus has been suffered to become permanent, the principal indication has been overlooked. The cases of Sabatier and many other afford abundant proof of this fact. There is reason to believe that the well-timed exhibition of a single purgative might often prove sufficient for the intention. Every thing will depend therefore on the vigilance and temper of the surgeon. If the food is rapid and little changed in its passage, it should be pultaceous and nutritive, and given in moderate quantity at short intervals; while injections of the same kind should be administered at least twice in twenty-four hours, and retained as long as

* This opinion is to be regarded as of general, not universal application. I am aware of possible impediments to the restoration of the canal.

possible. It is an unquestionable fact that persons have been nourished for the space of many weeks by such means; of which, if it were necessary, I could adduce a remarkable example. If the discharge is sparing and does not readily escape, an occasional purgative in less than ordinary quantity will be necessary. Medicine of any other description, and stimulants, such as wine and malt liquors, will more probably disturb by over exciting the weakened system, than promote the object of their administration. Such articles of diet as are apt to offend a delicate stomach, especially such as are of difficult digestion, should be scrupulously avoided. Animal food in a gelatinous form will be generally preferable to vegetables and slops. The nature and circumstances of the evacuation create much local irritation, and the comfort of the patient demands a frequent renewal of the dressings. In applying them the surgeon should be careful to avoid cramming the wound with tents and sponges.

When the artificial anus is complicated with prolapsus, as is most frequently the case when the discharge has been long established, it very rarely admits of cure. The ingenious memoir before cited from the second volume of the works of Desault, contains all the matter on this subject at present known. Other cures have been reported; and it is certain that many attempts have failed. M. Pelletan, of the Hotel Dieu, protests in his late publication against the authenticity of these details, and vehemently deprecates the practice.

It is the prevention of the disease to which I would invite the attention of surgeons, believing it to be as much easier as it is always better than cure. And I would encourage the hope, if it were not presumptuous, that the ideas thrown out in the course of this Inquiry, may so assist in directing the judgment of the profession, as to render of rare occurrence if not to obviate a calamity, which so materially depreciates the blessing of existence.

APPENDIX.

THE cases which follow are of recent date, and further elucidate some points of importance in the discussion. I have introduced them in this form because they have happened since the printing of the pages to which they refer, or did not admit of being conveniently placed in the text.

CASE I.

Mr. W ———, æt. 35, led an active but irregular life, by which his constitution was injured; and he was frequently the subject of local disease. In 1808 he had a troublesome abscess in his thigh, and two years afterwards a sinuous ulcer, situated at the outer angle of the orbit, on account of which he consulted, at different times, some of the most eminent of the profession. This and other sores to which he had been subject, were of that anomalous character which indicates a disordered state of the digestive organs. Their function was in him much impaired. Under the direction of that acute physiologist and scientific surgeon to whom the profession is indebted for an acquaintance with the origin and treatment of these diseases, his general health was improved and the ulcer healed. He continued however, to make vague complaints of indigestion and muscular debility, when I saw him about three months before his death. His high spirits were evidently less natural than formerly; his muscular flesh was flabby, and somewhat wasted, and his complexion thick and sallow. About six

o'clock one evening in February, he sent me an urgent request to visit him immediately. I did so, and found him in a state of extreme suffering. He had been dining in company, and was seized on a sudden with an excruciating pain in the belly, which he described as unlike what he had ever felt. The principal seat of his pain, which never remitted for an instant, was the region of the navel; but it sometimes spread from this point, as from a centre, over his whole body, even to his limbs, and especially affected his neck and shoulders. His abdomen was already distended and hard. I directed a warm fomentation to be applied to the abdomen; he experienced no relief, and I bled him freely. His respiration was hurried, but his pulse little if at all affected. Flatus rose in quantity from his stomach, but he did not vomit. After some time, finding his torture to increase, I desired a consultation, and my friend Dr. Birkbeck saw him. Some calomel and opium were immediately given and quickly followed by a saline cathartic, which was directed to be frequently repeated. At midnight the medicine had not operated; he could not bear his belly to be touched; often he roared out with pain, and wished to be relieved by death. I took another basin of blood from his arm. A glyster was directed to be injected, and a warm bath to be prepared as soon as possible. He often called for a spoonful of gruel, which returned without the effort of retching, after he had swallowed it. 3 a. m. His pain was not mitigated; his pulse was small, and intermitted very irregularly. He was perfectly sensible, but his strength was almost exhausted. His extremities became cold; and he died in the bath at 6 a. m. about thirteen hours after the first attack of pain.

Inspection.—Putrefaction advanced: belly tumid. The red dotted surfaces of the peritoneum bespoke the presence of an irritating fluid; and the sides of the belly and pelvis held a large quantity of fluid highly tinged with bile. The canal was attentively inspected throughout. About a finger's breadth below the pylorus was a circular hole with a thin margin, large enough to admit a writing pen. Upon inspecting the villous surface, it proved to be the centre of an irregular ulcer, which had destroyed that coat to an extent including two thirds of the ring of the pylorus. There was no other appearance of ulceration.

CASE II.

A well grown young man was brought into Guy's Hospital, dangerously wounded in the belly by a pistol shot, at eight o'clock on the evening of Saturday, the 2nd of November, 1811. I was present, and examined his wound. It was situated below the ribs on the right side, but was plugged by a piece of omentum. He complained of pain. His skin was pale and chilled; his pulse regular. He was put to bed, the wound poulticed, belly fomented, and sixteen ounces of blood were drawn from the arm. In an hour his pulse had risen to 90; he was more uneasy in his belly; his respiration was oppressed, and his mouth parched. At eleven, his pulse rising and remaining regular, and his pain continuing, the bleeding was repeated. He passed a sleepless and painful night, often taking liquids to relieve the dryness of his mouth and fauces. Towards morning his distress greatly increased; his belly was swelled and tense, especially in the region of the wound; his pulse was

feeble and fluttering; a circumscribed blush appeared upon his cheeks, but they were cold to the touch. He complained greatly of the tightness and pain of his belly, and could not void his urine; a small quantity was drawn off by a catheter. The pain and restlessness increased, and a few minutes before eleven o'clock he died.

Inspection.—The belly was tumid; the peritoneal surface mottled; a portion of the colic omentum passed through the wound. The anterior edge of the right lobe of the liver was fissured close to the gall bladder, by a wound which would admit the palm of the hand; and opposite to it a lacerated aperture of the size of a shilling appeared in the arch of the colon, marking the track of the slug. The hepatic bile and fæces were copiously effused. Upon introducing my finger into the gut, I drew from it a cylindrical piece of lead, a full inch in length.

The pain suffered in the former of these cases was more acute than in the latter; and the discoloration of the peritoneum, though it had the same character, was more vivid. In the former, the bile passed directly from the gall duct into the abdomen, as well as the contents of the stomach. Vinous tinctures, which had been taken in the commencement of the attack must have aggravated the pain. In the latter case, the hepatic bile and blood oozed from the cleft of the liver over the intestines. The lead was so situated as to have admitted of a ready evacuation *per anum*, and but for the accompanying wound of the liver, this young man would probably have recovered.—See the case quoted from Ravaton, page 63.

CASE III.

I regret that the following valuable communication which was obligingly sent to me by Mr. Brodie, of St. George's Hospital, did not reach me until I had proceeded too far to introduce it in its proper place.

“Michael Orgell, who had been subject to the occasional protrusion of an inguinal hernia, from the time of his being an infant, was admitted into St. George's Hospital about 5 P.M. on the 7th of October, 1806, with the hernia in a state of strangulation.

He said the strangulation had existed for 16 hours, and that he had had no evacuation for 30 hours before his admission.

At this time the hernia was of the size of a small orange, and both the tumour and the abdomen were very painful when pressed; his pulse was hard and dry. He had occasional hiccup, and vomited frequently. Eighteen ounces of blood were taken from his arm; he was put into the warm bath, a clyster of infusion of tobacco was administered, and attempts were made to reduce the hernia, but without success.

At eleven in the evening, Mr. Gunning, whose patient he was, performed the operation. The hernia was found to be congenital, and about six inches of the small intestine, of a red colour, were contained in the tunica vaginalis. The stricture was situated above the abdominal ring; and the reduction was effected with considerable difficulty. After the operation, a glyster of water was injected.

During the night, he had less pain than before the operation; but the hiccupping and vomiting continued.

On the following morning, October 8th, he had had no evacuation of fæces. The sickness continued. The pulse intermitted at irregular periods. Eight ounces of blood were taken from his arm. A purging draught was given him ; but it did not stay on his stomach.

During the day, he complained of pain in the abdomen ; the vomiting continued ; the intermission of the pulse was more frequent ; the tongue became dry, and covered with a brown fur. Purgative glysters were administered, and he took pills composed of calomel and extract of colocynth ; but no evacuation of fæces took place.

During the following night, all these symptoms increased ; the matter which he vomited had a feculent smell. He had some evacuations from the bowels, but they proved to be only the glysters which had been previously thrown up.

October 9th. His pulse was weak and fluttering ; the vomiting continued ; he fell into a state of stupor, and died at five o'clock in the afternoon.

Inspection.—On opening the abdomen, the peritoneum generally bore marks of inflammation. The impression of the stricture still remained on the small intestine. That portion of the gut which had formed the hernia, was of a dark colour, but not mortified. Coagulated lymph had been effused, which glued this and the neighbouring portions of intestine to each other, in such a way, that the canal made several very acute turns upon itself. The upper portion of the small intestine was much distended by its contents, which did not appear to have passed beyond the convolutions thus glued together."

The following case to the same purport has occurred within the last week. Its circumstances are all fresh in my mind ; and I introduce it to shew that such melancholy proofs of the actual insufficiency of the ordinary method of treatment, are, as I have stated, not uncommon.

CASE IV.

Mrs. G——, aged 61, had a crural hernia in the left groin, which had been strangulated six days. No relief had been attempted. She had experienced all the symptoms of strangulation ; and by their long continuance she appeared to be greatly exhausted. It was judged proper, upon examination, to operate without delay. The operation was performed with great precision and ability. A knuckle of small intestine, much discolored but tense, was embedded in a bunch of omentum. The stricture, which was tight and unyielding, was moderately dilated, and the gut carefully replaced in the belly. The omentum was irreducible from adhesion to the neck of the sac, and was therefore left in its situation. An hour afterwards, her pulse was, as before the operation, small and languid ; her belly was not tender to the touch, and she was free from hiccough and vomiting. She made no complaint, except of thirst, which was from time to time relieved by a little warm tea.—Five o'clock p.m. (three hours after the operation) She has vomited fæculent matter twice, of consistence and in quantity. Pulse increased in frequency (112) and becoming full. A poultice was ordered to be applied to the stomach, and she took a pill containing a grain of opium.—Eight o'clock p.m. She has vomited once and copiously since the last visit, and has been heard to hiccup occasionally. Does not complain of

pain—has passed flatus, but has no call to stool.—Eleven o'clock p. m. Complains much of lowness, but not of pain; pulse about 100; has a great longing for a draught of warm porter, which she thinks would procure her a motion—has not vomited since last visit. An enema of castor oil was injected; and two drachms of Epsom salt, with one of magnesia, given in a draught. She was allowed to take porter in small quantities.

Next morning. Eight o'clock. Both the medicine and clyster remained with her, but without any operation upon her bowels, although she has felt frequent inclination to stool; her pulse is very slow and feeble, extremities cold, and countenance sunk. Eleven o'clock. Has vomited fæces many times since the last visit, and is now dying.

Inspection.—Upon opening the inflated belly, the transverse colon appeared drawn downwards into a triangular form by the omentum, which, adhering to the sac, concealed the small intestines from the view. The stomach and duodenum were healthy, nor did I discover any mark of inflammation until having cut across and reflected the omentum, I had advanced some way in tracing the jejunum. This intestine was greatly distended with air; and some stripes of a red color passing parallel to each other, appeared upon the surface of the bowel. Upon the ileon these stripes were of a deeper hue, and the contents of this bowel felt solid and heavy. The recently strictured piece was conspicuous, being of the same color and texture as when returned; it was from an inch and a half to two inches long, and bounded by the groove-like indentations of the stricture. Above it the fæcal matter was accumulated in great quantity, and the tube

which bore the marks of stricture was equally distended by excrement, consistent enough to retain the figure of the bowel when afterwards pressed out of it. In this paralysed portion of the tube it had been arrested; for at the lower circle of the stricture, the gut changed so abruptly its color and diameter as not to appear a part of the canal. It was pale, perfectly empty, and contracted to its smallest capacity all the way to the caput coli, which held a few knobs of fæcal matter. The remainder of the large bowel was collapsed.

[See the cases of hernia unrelieved by the operation in Ch. VI.]

CASE V.

I extract the following from a letter which I received from my friend Dr. Fearon of Sunderland.

“The case of which I spoke did not end for a considerable time after I heard from you, and at last it did not end as I had expected or wished. I am solicitous to see the detail of your experiments and observations, as the general principles appear to me extremely plausible within certain limits, and they are in a great degree confirmed by the case to which I have referred. I forget what I may have formerly said of this, but it was shortly as follows. A small femoral hernia occurred in a man past the middle age, who had been born to good circumstances, but had been reduced to severe manual labour, and who had been a dissolute drunken fellow. The hernia could not be reduced, and was operated on: copious fæculent discharges took place from the wound for some time, which had greatly diminished when I wrote to you, fæces passing naturally and regularly by the anus. The discharge at the groin

ceased wholly for a time; some swelling took place near the wound, suppuration followed, and the fæces again came by the wound; they continued to do so for some time, and the man at length died. On opening the body, the canal of the intestine on the inner side was perfect, a small hole existed on the opposite side between the diameter of a sixpence and a shilling, round which strong adhesions had taken place to the parietes. There was no inflammation within the cavity. Much inflammation and some gangrene existed on the upper part of the thigh, which was the cause of the man's death.

I have said that your principles appear plausible to a certain extent, because not knowing your facts, I am at a loss to conceive by what means it is that when a portion of intestine, some inches in length, is suffered to slough away, the canal is preserved, and the external wound closed over it, as you say that the artificial anus seldom follows. The case I have quoted proves the adhesions of which you speak, the danger of severing these by returning the intestine forcibly, and the freedom from internal injury or extravasation which follows your treatment. The deep situation of the opening in the gut, under Poupart's ligament, which rendered the full and free discharge of the fæces less easy, together with the man's bad habit of body which made this discharge produce more irritation and inflammation than would probably have occurred in a more healthy subject, alone, I conceive, prevented the process of closure being completed."



Fig. 1.

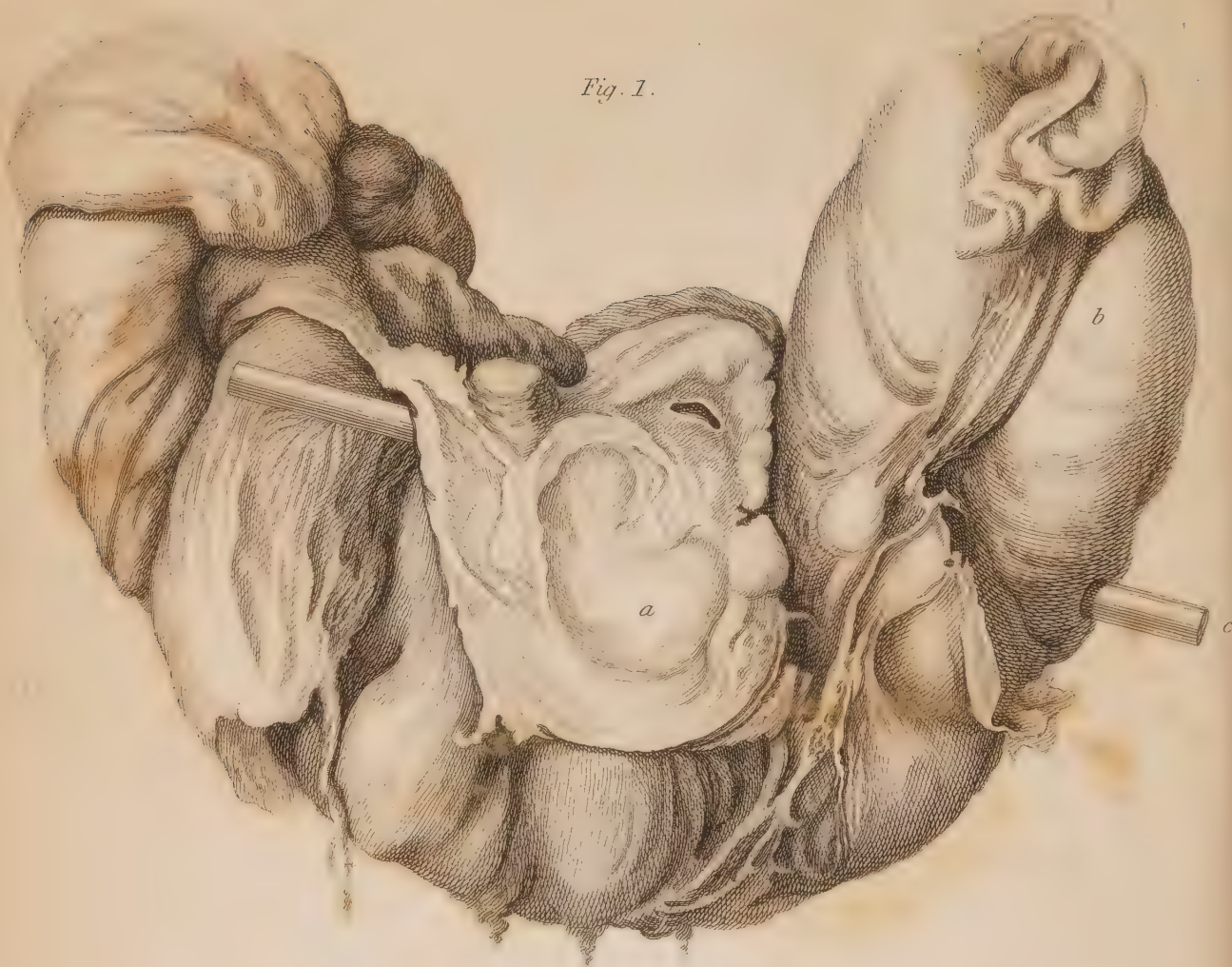


Fig. 2.



Fig. 3.



Engraved by J. Stewart.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1 shews the size and direction of the wound in the duodenum which was unaccompanied by effusion of the contents of the bowel. (See page 21.)

a—a portion of the pancreas.

b—the jejunum.

c—a bougie in the position of the bayonet.

This figure is from a drawing by Mr. Thompson.

Fig. 2 shews the contraction of the muscular and the permanent eversion of the mucous coat, which follows an incised wound of the bowel. (See page 85.)

Fig. 3 shews the aperture of an intestine by a process of ulceration, in which the mucous coat being more extensively destroyed than the peritoneal, no eversion can take place. A shred of peritoneum not destroyed by ulceration is seen crossing the aperture, and a pellicle of lymph has been partially deposited around its thin, jagged margin. (See the conclusions at page 46.)

EXPLANATION OF THE PLATES.

PLATE II.

Fig. 1 represents the mode of reparation of an aperture in the intestine. (See Exper. D, page 55.)

a—A portion of the peritoneum lining the abdominal muscles.

b—The wounded gut.

c—A band of lymph passing from the peritoneum, uniting the contiguous folds, and thus obliterating the triangular interstice betwixt them.

d—An incision into the lymph connecting the folds by which a probe passed obliquely through the aperture, still complete in *b*.

Fig. 2 represents, in a transverse section of the small intestine, the consequent eversion and contraction, and the obliteration of the tube by a plug of chylous matter. (See Exp. L, page 94.)

a.a—The everted lips strictured and rendered tumid by the strong circular contraction of the tube at their bases. The diameter of the tube is marked by that of the condensed alimentary matter shutting up the orifices of the bowel, so as to render the surfaces plain, and prevent the escape of fluids.


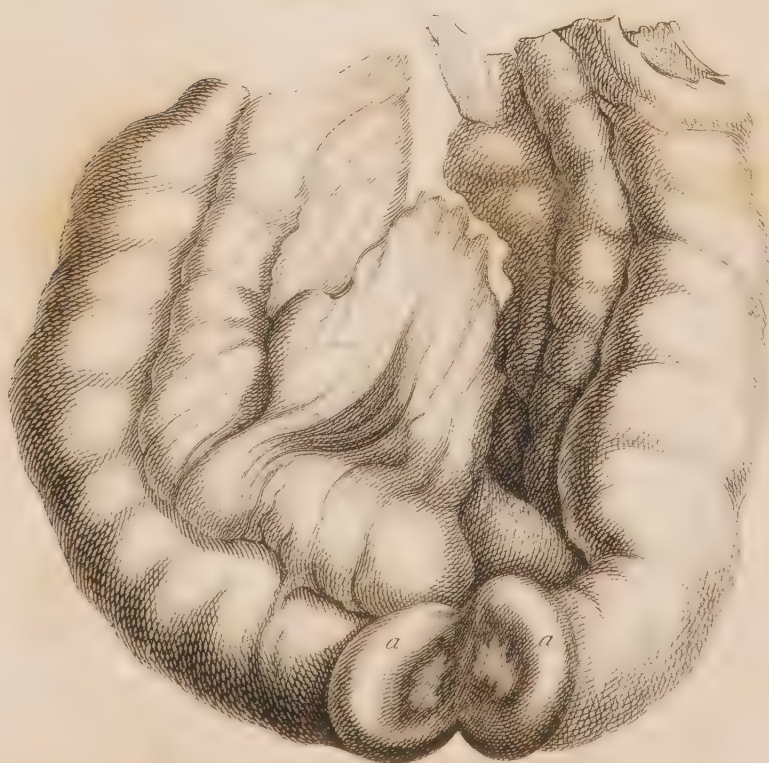


Fig. 1.



Fig. 2.



Engraved by J. Stewart.

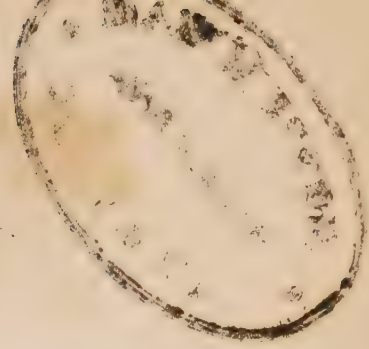


Fig. 1.

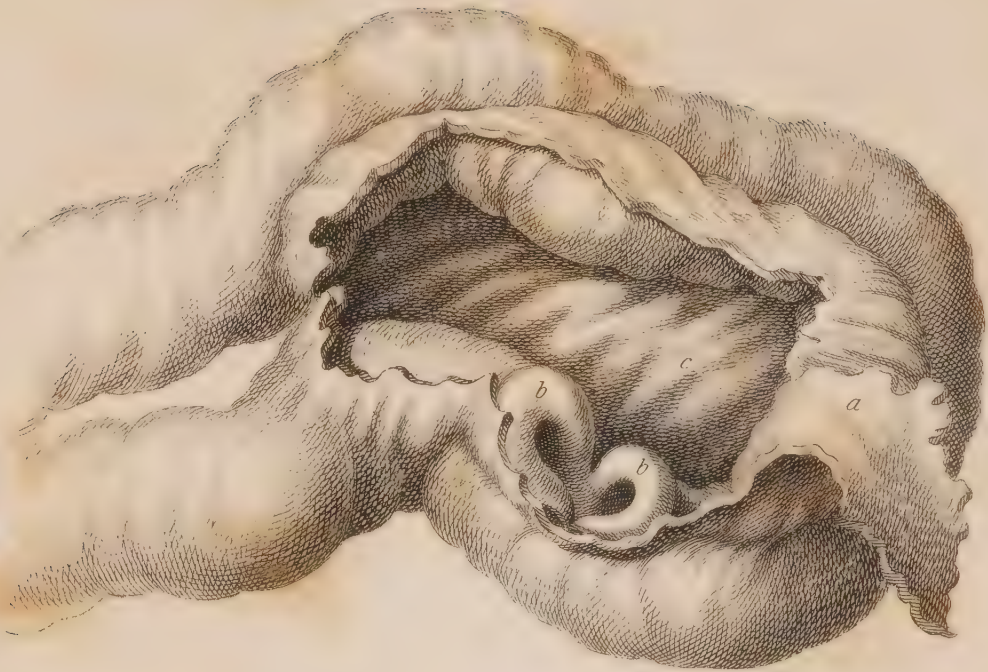


Fig. 2.

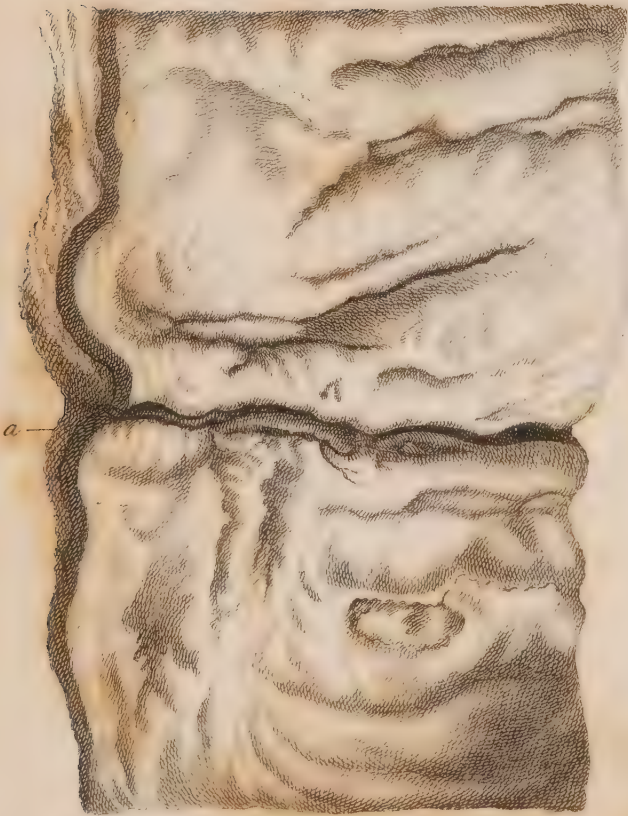
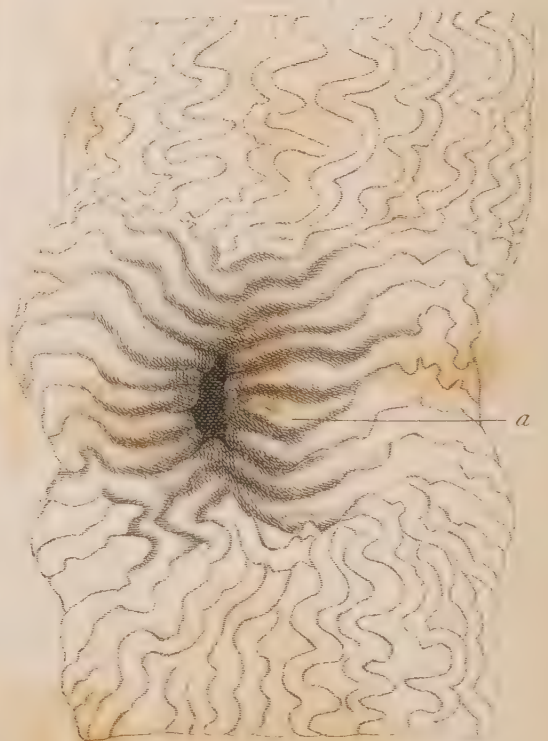


Fig. 3.



Engraved by J. Stewart.

EXPLANATION OF THE PLATES.

PLATE III.

Fig. 1 A pouch, or cul de sac, formed after the semi-division of the intestine. (Exper. N, page 95.)

a—The mesentery of the wounded gut, cut through and reverted, brings into view

b b—The half everted lips and the orifices of the divided gut, by the upper of which the matters passed into the pouch.

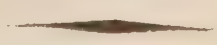
c—Another portion of mesentery supported by an adjacent fold. The parietal peritoneum, which is not seen in this view, completed the pouch on the same side.

Fig. 2 exhibits the internal surface of an intestine after the application of a ligature. (Exper. O, page 98.)

a—A transverse fissure in the villous surface, marking the line of division, the edges of which are slightly everted.

Fig. 3 exhibits the internal surface of an intestine after the healing of a longitudinal wound. (Exper. P, page 106.)

a—The fissure with everted edges, much shortened by the contraction of the muscular fibres and the puckering of the mucous coat.



EXPLANATION OF THE PLATES.

PLATE IV.

Fig. 1 shews the effect of a ligature applied to an aperture in the paries intestinalis. (Exper. Q, page 111.)

a—The muscular peritoneum.

b—The injured fold opened posteriorly, to shew the blackened knot of the ligature filling the aperture. Anteriorly it adheres closely to the peritoneum, below to the adjacent fold of bowel.

Fig. 2 shews the pernicious effect of a single ligature applied to the edges of a divided intestine opposite to its connection with the mesentery. (Exper. R, page 116.)

The outline on the left of the figure is intended to represent the pancreas, which in the dog is parallel to the duodenum.

a—Part of the omentum.

b. b—Masses of lymph deposited rudely around, which in part concealed the apertures.

A worm is seen at one of the orifices.

Fig. 3 shews the effect of three stitches passed so near to the edges of a divided gut, as to produce only partial contact. (Exp. S, page 118.)

Fig. 1.



Fig. 2.



Fig. 3.



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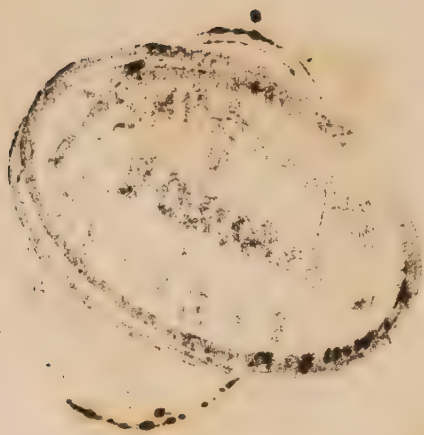




Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



Engraved by J. Stewart.

EXPLANATION OF THE PLATES.

PLATE V.

For the Preparations represented in Figures 1 and 2 I am indebted to the kindness of my preceptor and friend, Dr. Thomson, of Edinburgh. See page 124.

Fig. 1 exhibits the internal surface of an intestine united by five interrupted stitches, on the tenth day from the operation.

a—The peritoneal union. Some fissures on the everted edges of the villous coat are still apparent, and two of the ligatures remain attached to the lower edge.

b—A bosse of adhering omentum.

Fig. 2. Dr. Thomson's Second Experiment, (page 125.)

The preparation which this figure represents was taken six weeks after the Experiment. The gut is inverted, and the portions of the villous edges upon which the threads hang loosely, are vascular.

Fig. 3 shews the internal surface of an intestine united by a neat continued suture, at ten weeks from the Experiment. A small sewing needle and silk ligature were employed.

Fig. 4—Union effected in the same way, after a semi-division of the intestine; examined at two months from the Experiment.

N. B. In these figures the interstice is a mere line ; but the eversion of the edges is distinct. The ligature is wholly disposed of; but the traces of it are still visible in Fig. 3. From a comparison of Figures 1 and 3, I am led to prefer the uninterrupted suture. It approaches nearest to the union after division by stricture.—Compare with Fig. 2, Plate III.

EXPLANATION OF THE PLATES.

PLATE VI.

Fig. 1 represents the anterior view of the extremities of the gut in a mortified hernia in which the stricture was freely divided on the fourteenth day from the operation. A piece of omentum included in the stricture had separated.

a. a—The peritoneum covering the Psoas and Iliac muscles.

b. b—The two portions of gut connected by the mesentery, and fixed in an angular position by very strong but defined adhesions to the peritoneum. The upper of the two bristles passes into the artificial anus, or ventricular portion. A considerable part of the circumference of each orifice has an even margin, where it had been directly opposed to the stricture, but at the lower part it is rendered irregular by

c.—A tongue-like prolongation of the villous coat, which has not been included in the slough.

Fig. 2 is a posterior view of the same, shewing the firmness of the peritoneal adhesions, which retained the parts *in situ*. (See case of Aston, page 20.)

Fig. 1.

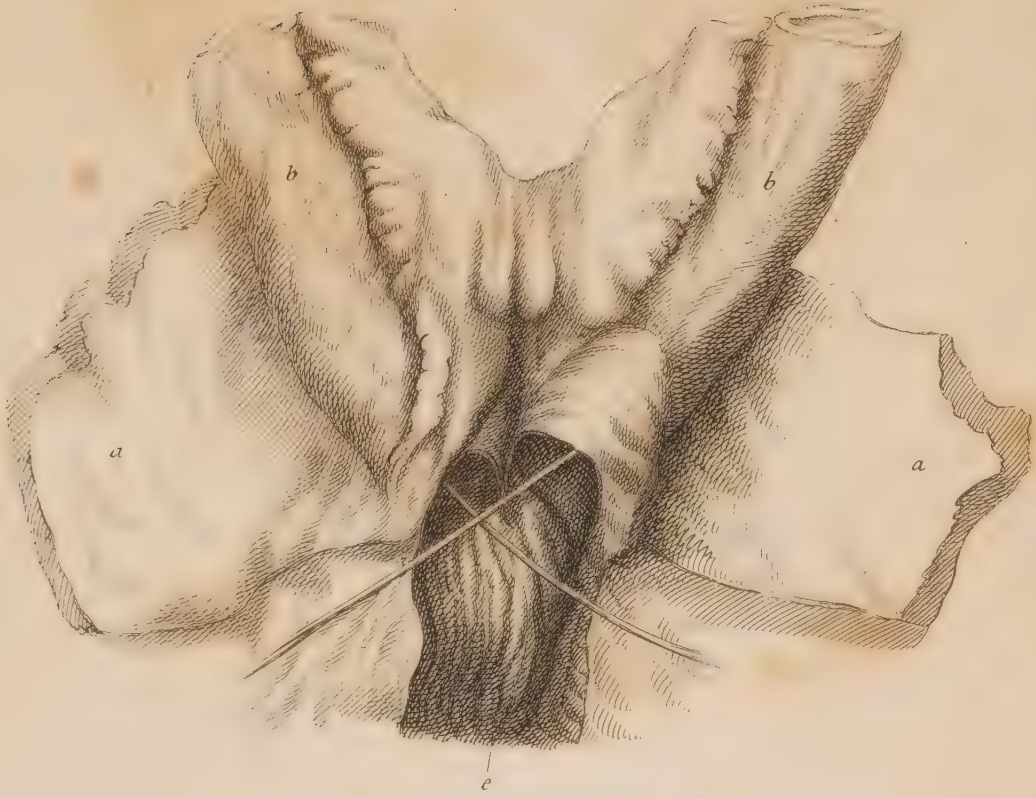


Fig. 2.



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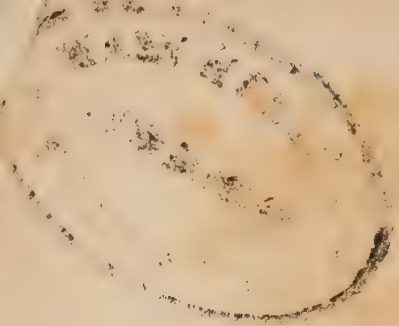


Fig. 1.

Plate .

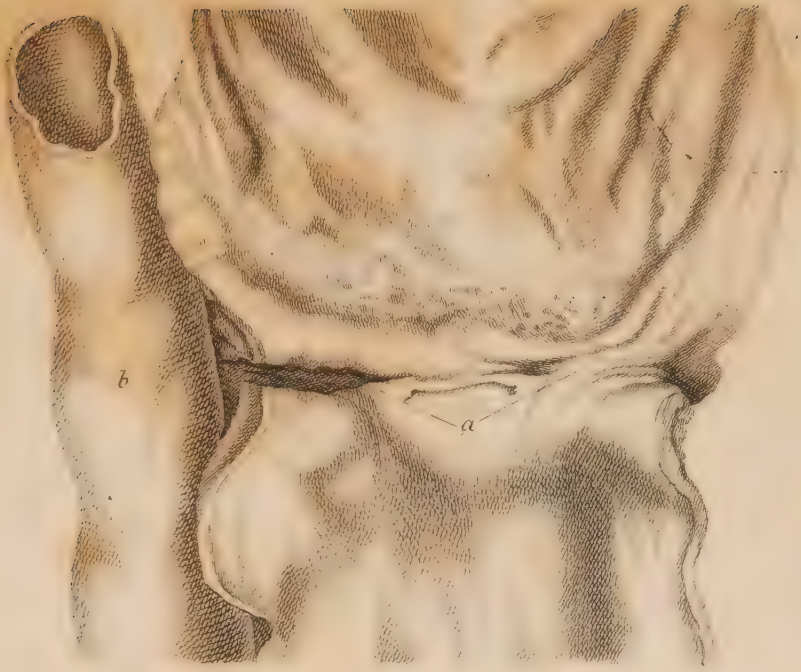


Fig. 2.





EXPLANATION OF THE PLATES.

PLATE VII.

Fig. 1 exhibits the internal surface of the bowel, examined a fortnight after the strangulation of the extremities of *a* fold by ligature. (See Exper. X. page 342.)

a—The line of division of the villous coat.

b—A contiguous portion of gut closely adhering to and supporting that which was the subject of the injury.

Fig. 2 is the result of Exper. Y. page 345.

a a—A longitudinal section of the gut, the extremities of which adhere by their contiguous sides, and open into

b.b.b—the omental cyst including the slough of the knuckle, which is seen suspended from the internal angle by the ligature.

FINIS.

CORRIGENDA.

I am in doubt if I have correctly understood the meaning of M. La Motte in the quotation which is the subject of criticism, page 23. Among some of my friends whom I have consulted on this point, a diversity of opinion exists. But if the sense of the Author is the reverse of my statement, the spirit of the argument is confirmed by the fact to which it was misapplied.

In the Note pp. 54, 55, the words 'retention' and 'suppression' have been inadvertently transposed.

Page 124, line 5 from bottom, for 'uninterrupted,' read 'interrupted.'

Page 129, line 9 from bottom, for 'are' read 'is.'

Page 135, line 2 from bottom, for 'offer' read 'offers.'

Page 150, line 6, for 'system' read 'symptom.'

Page 209, line 7 from bottom, for 'should be' read 'should always be.'

Page 232, Note, and page 243, line 7 from bottom, for 'Pelletin' read 'Pelletan.'

Page 356, line 8 from bottom, dele 'and.'

Page 363, line 6, for 'form' read 'forms.'

